

FIG. 1

FIG. 2

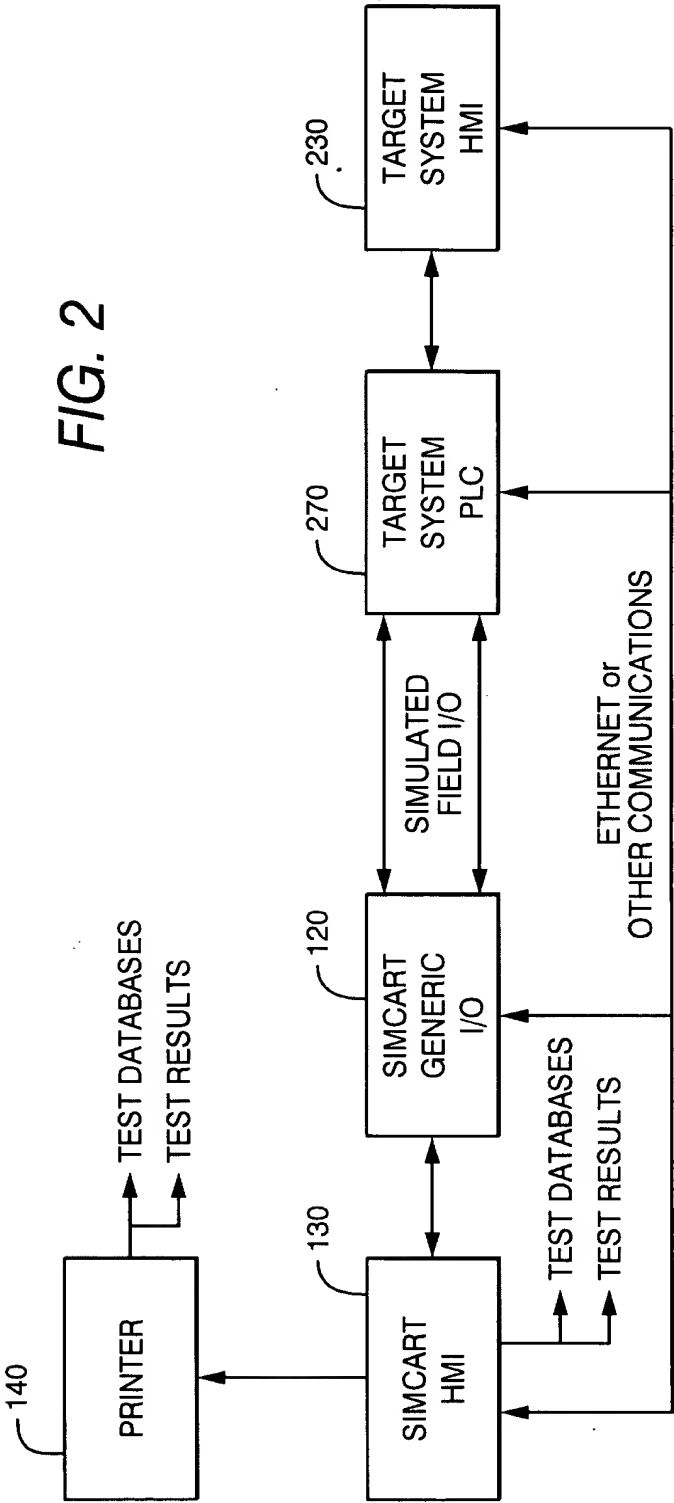
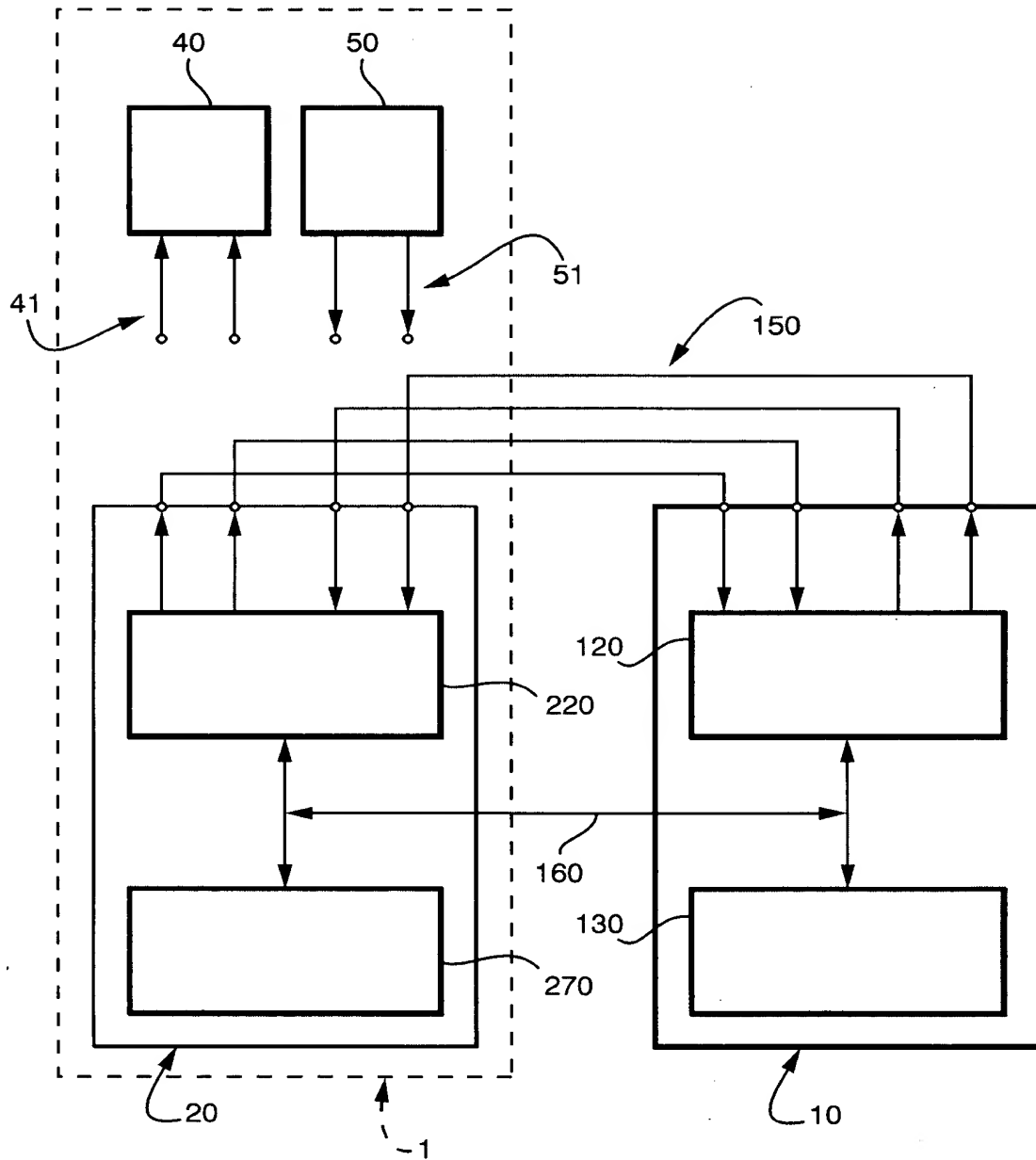


FIG. 3



<i>FIG. 4A-1</i>	<i>FIG. 4A-2</i>	<i>FIG. 4A-3</i>	<i>FIG. 4A-4</i>
<i>FIG. 4A-5</i>	<i>FIG. 4A-6</i>	<i>FIG. 4A-7</i>	<i>FIG. 4A-8</i>

***FIG. 4A******FIG. 4B***

<i>FIG. 4B-1</i>	<i>FIG. 4B-2</i>	<i>FIG. 4B-3</i>	<i>FIG. 4B-4</i>
<i>FIG. 4B-5</i>	<i>FIG. 4B-6</i>	<i>FIG. 4B-7</i>	<i>FIG. 4B-8</i>

FIG. 4A-1

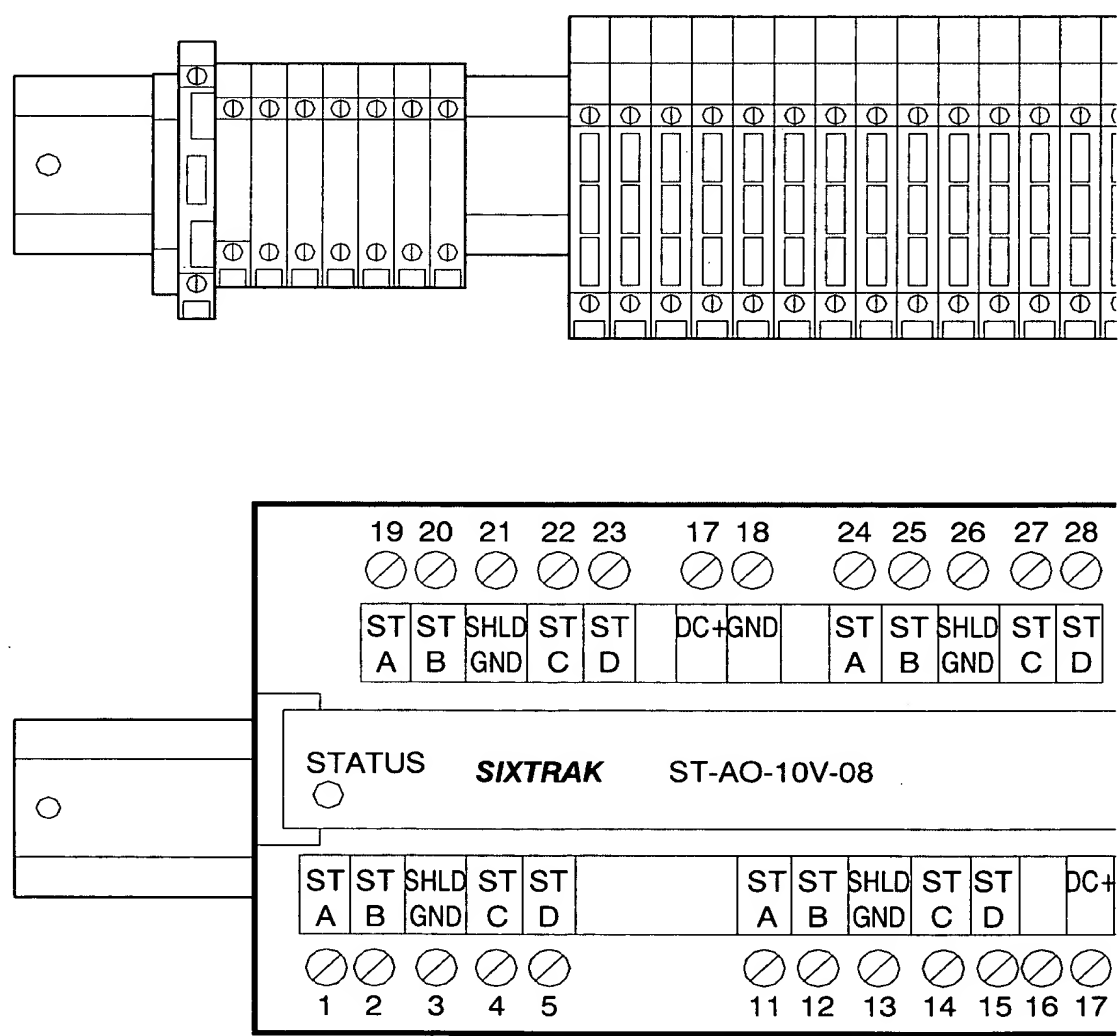


FIG. 4A-2

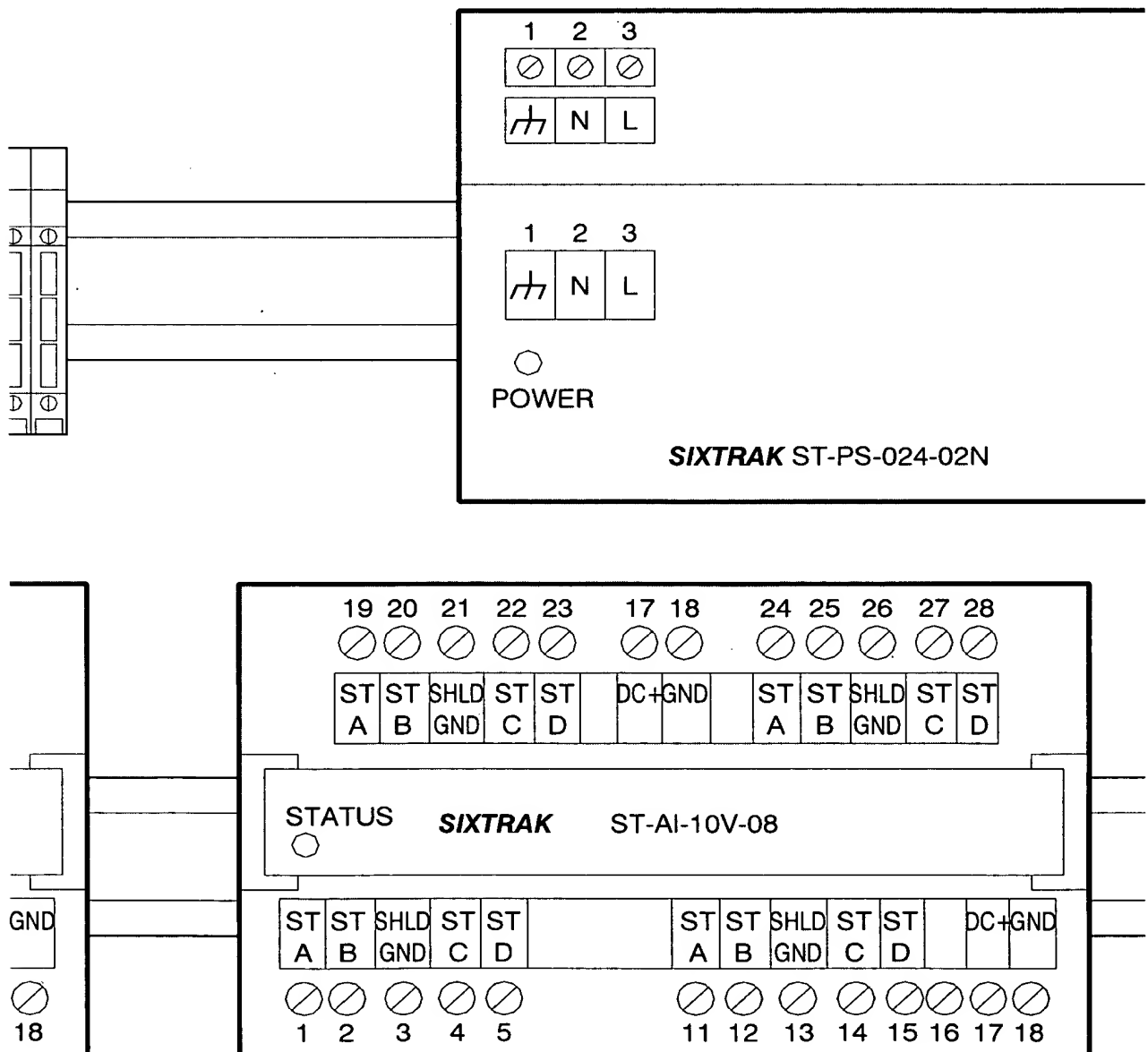
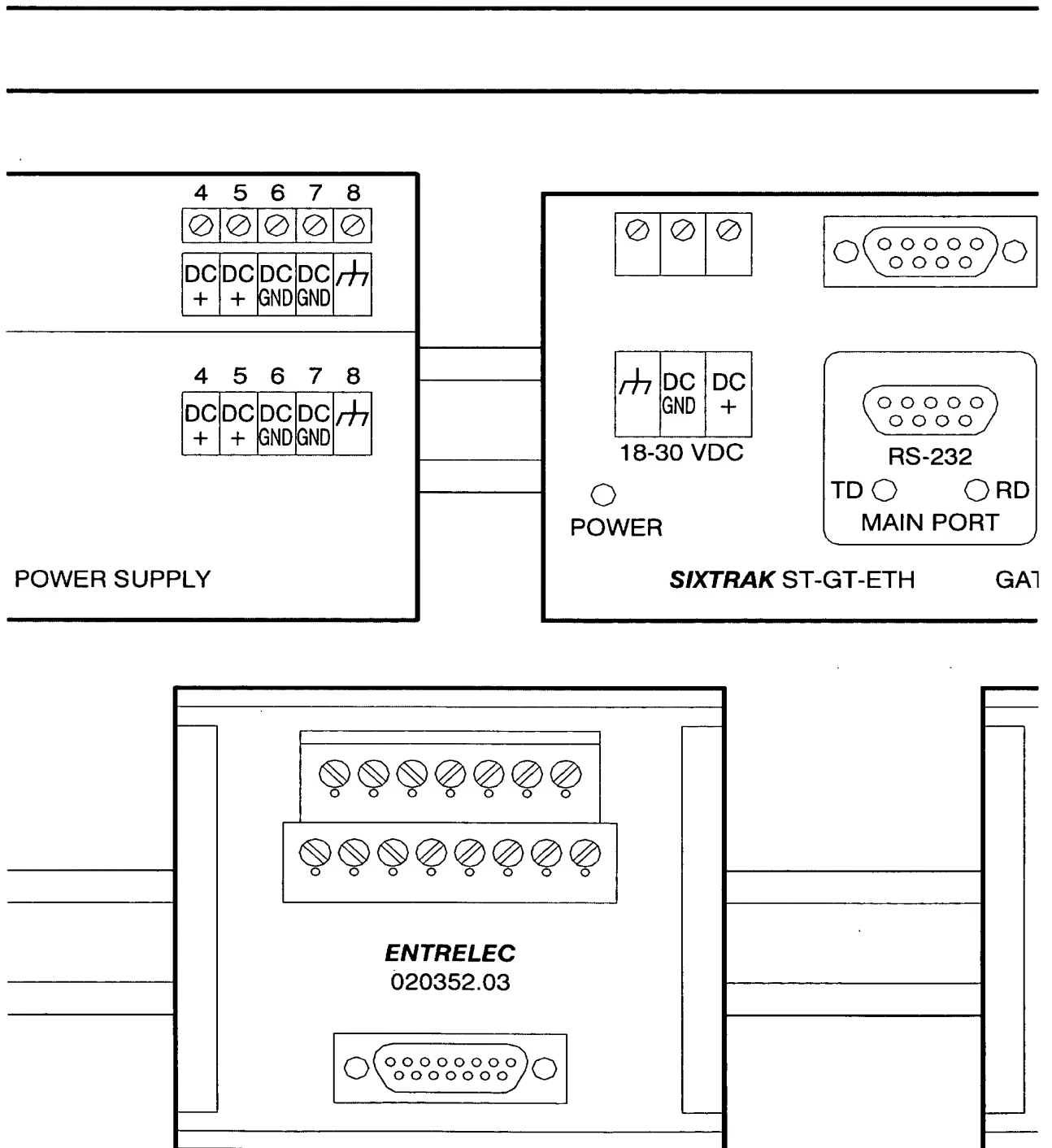
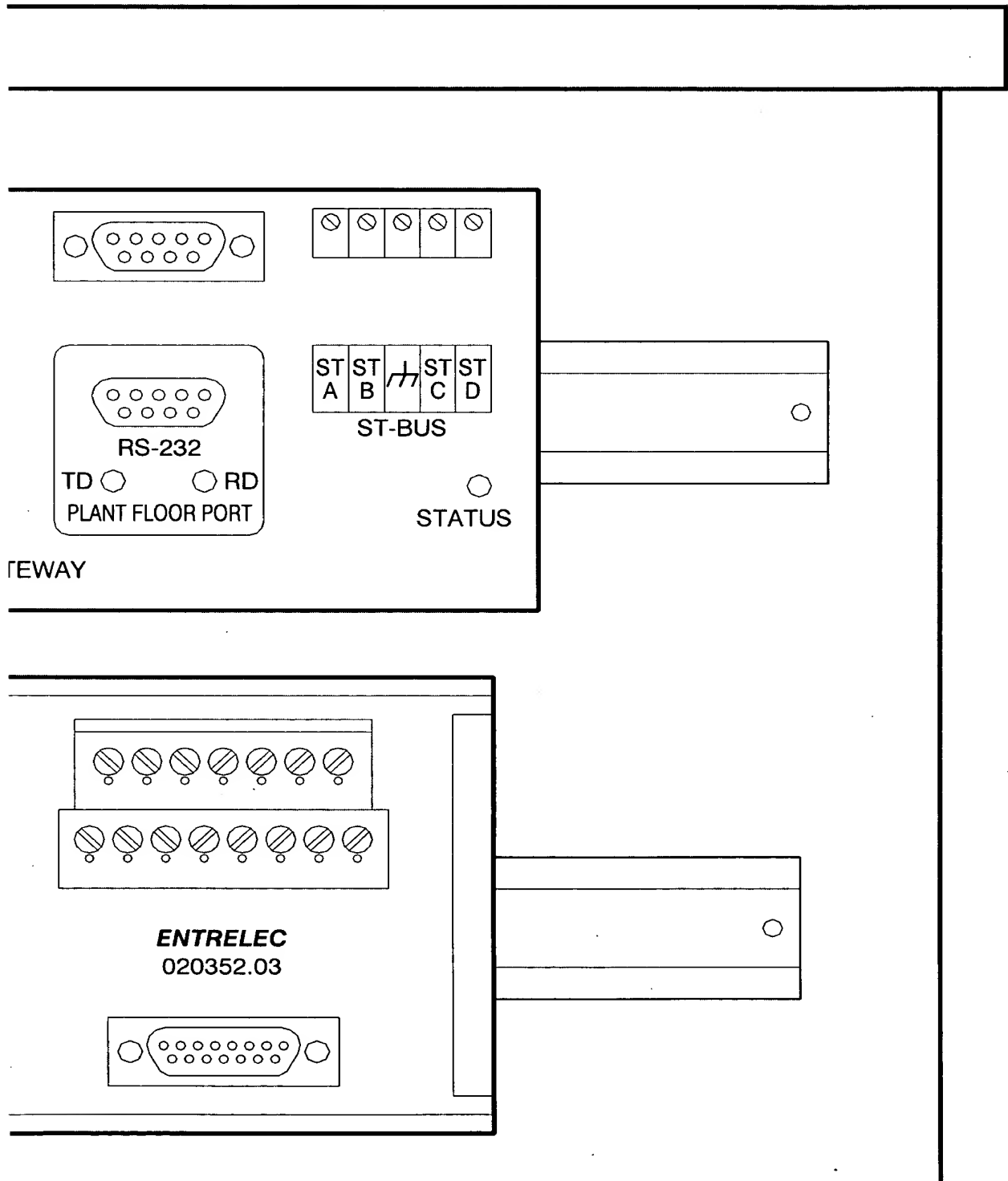


FIG. 4A-3



**FIG. 4A-4**



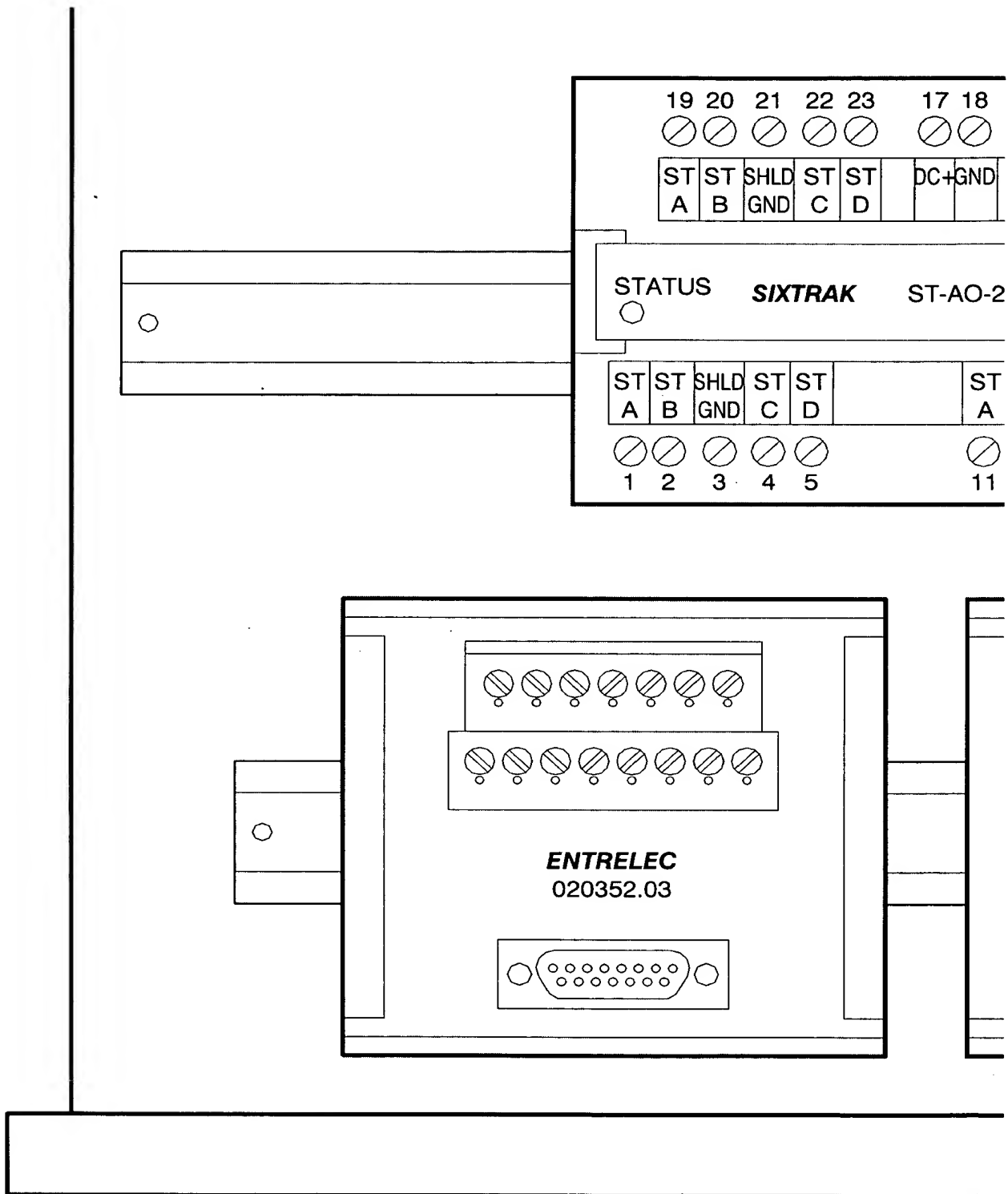


FIG. 4A-5

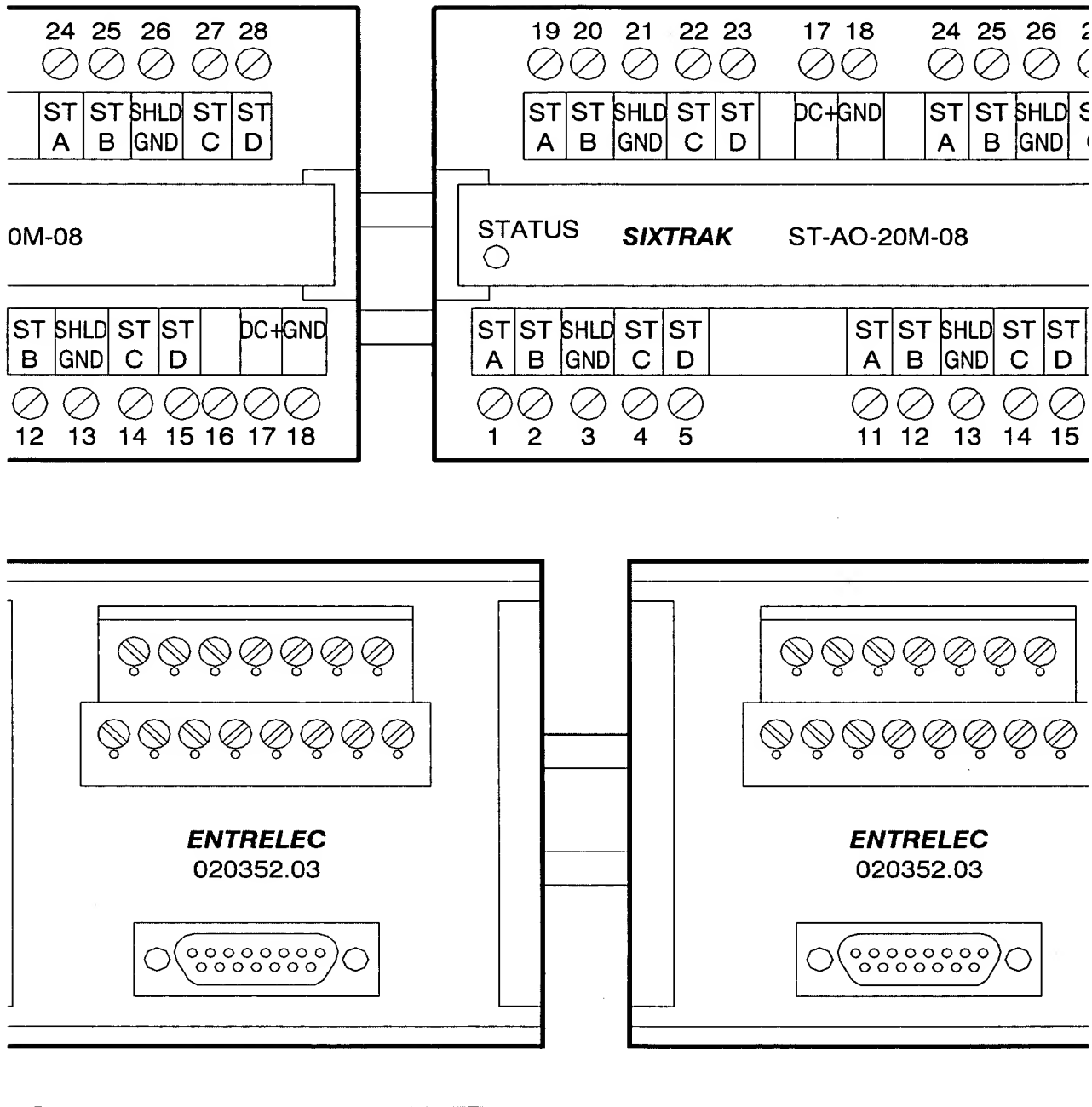


FIG. 4A-6

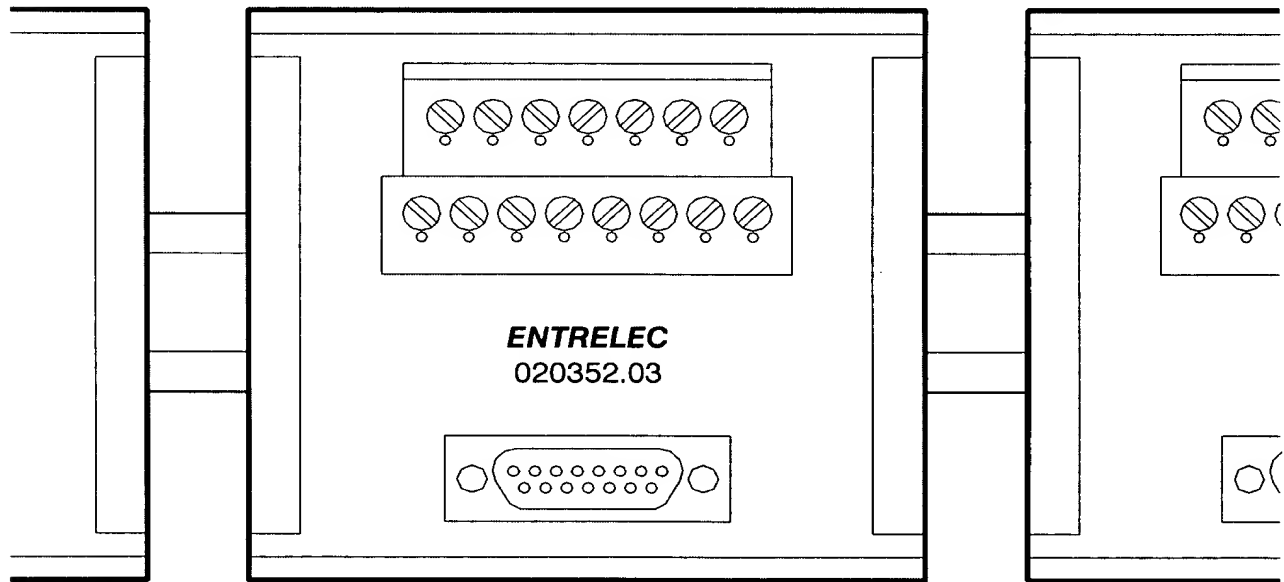
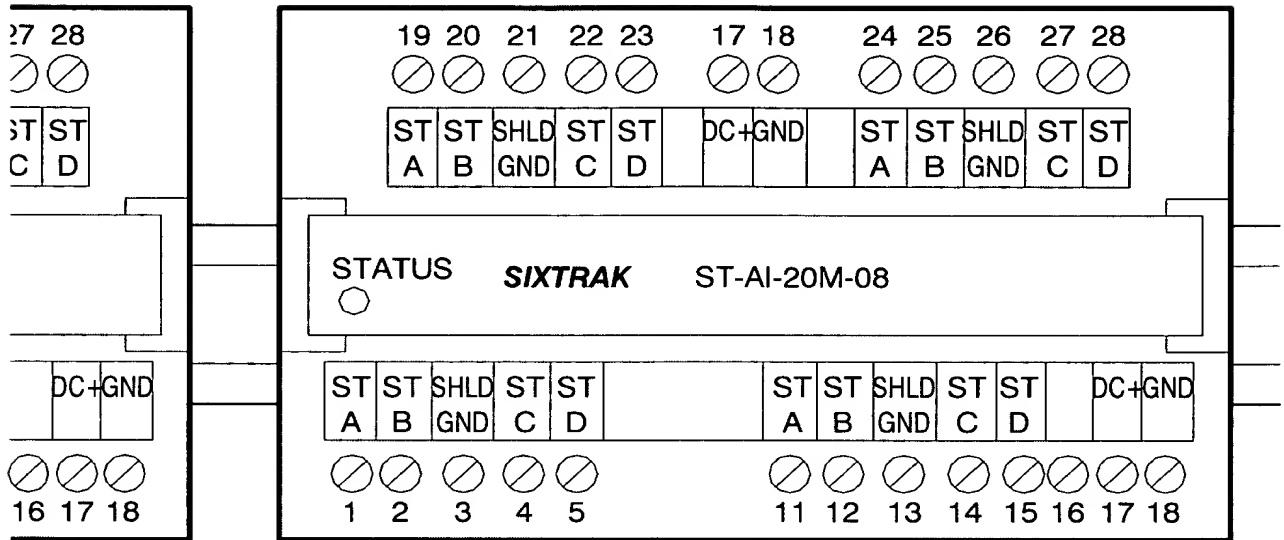
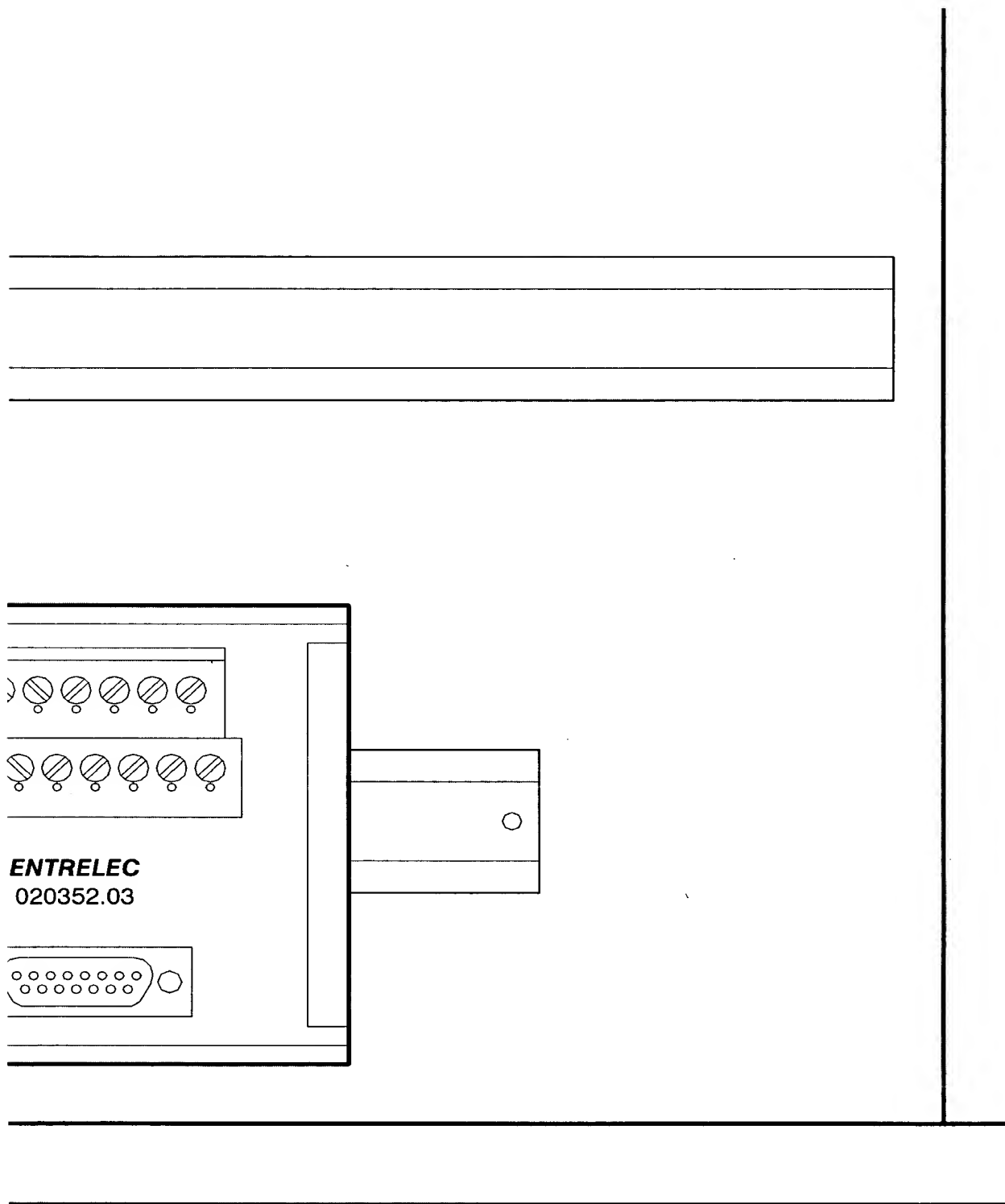
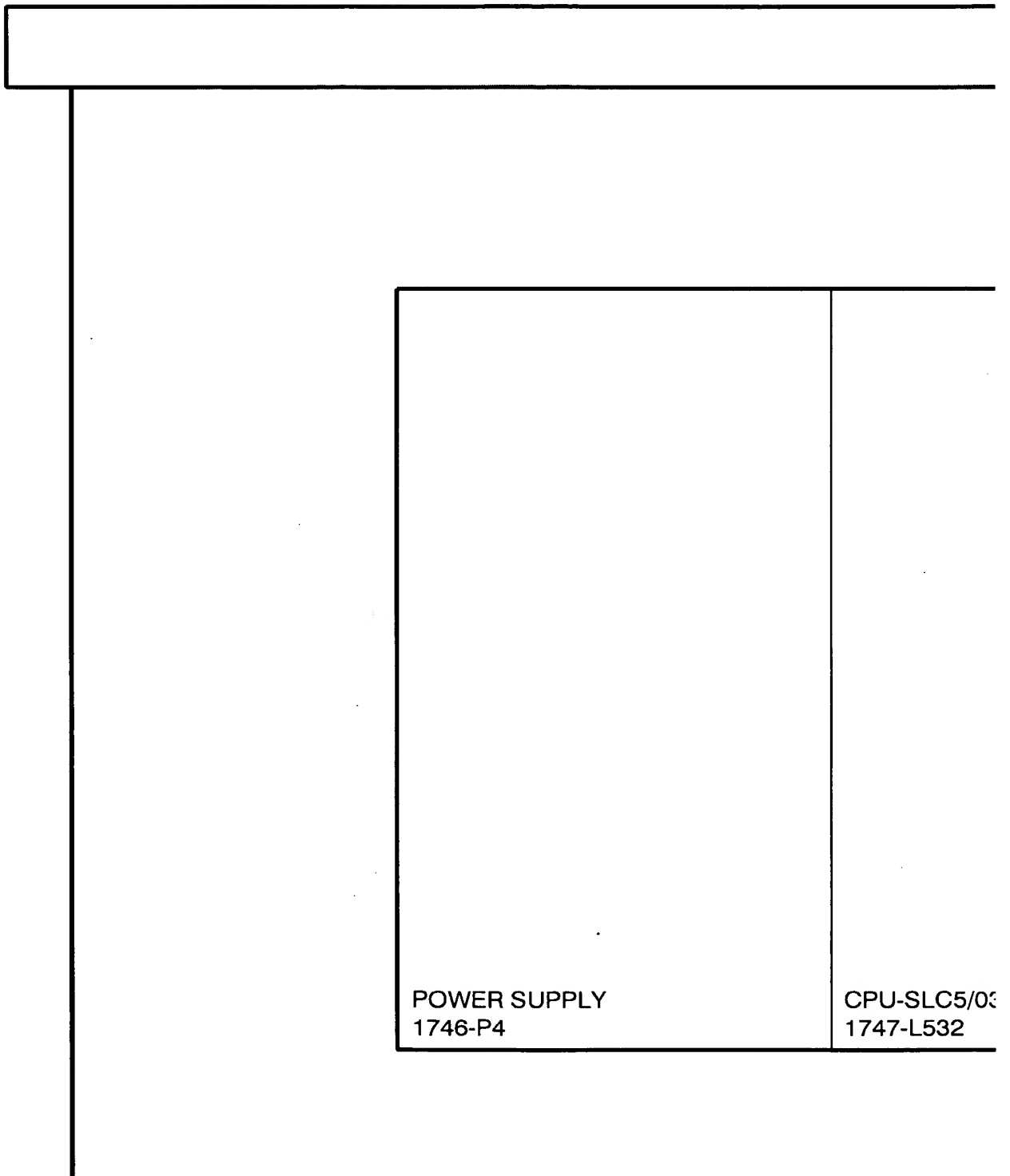


FIG. 4A-7



**FIG. 4A-8**

*FIG. 4B-1*



*FIG. 4B-2*

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---

	MODULE 1	MODULE 2	MODULE 3	MODULE 4	MODULI
3	AI (4-20mA) 1746-NI4	AI (4-20mA) 1746-NI4	AI/AO (4-20mA) 1746-NIO4I	AI (4-20mA) 1746-NI4	AI (4-20mA) 1746-NI4

*FIG. 4B-3*

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≡ 5	MODULE 6	MODULE 7	MODULE 8	MODULE 9	MODU
v)	AI/AO (0-5V) 1746-NIO4V	DI/DO (RELAY) 1746-IO12	DI/DO (RELAY) 1746-IO12	DI/DO (RELAY) 1746-IO12	AI/AO (0 1746-NIK

*FIG. 4B-4*

JE 10	MODULE 11	MODULE 12
1-5V) 04V	THERMOCOUPLE 1746-NT4	SCANNER 1746-SN



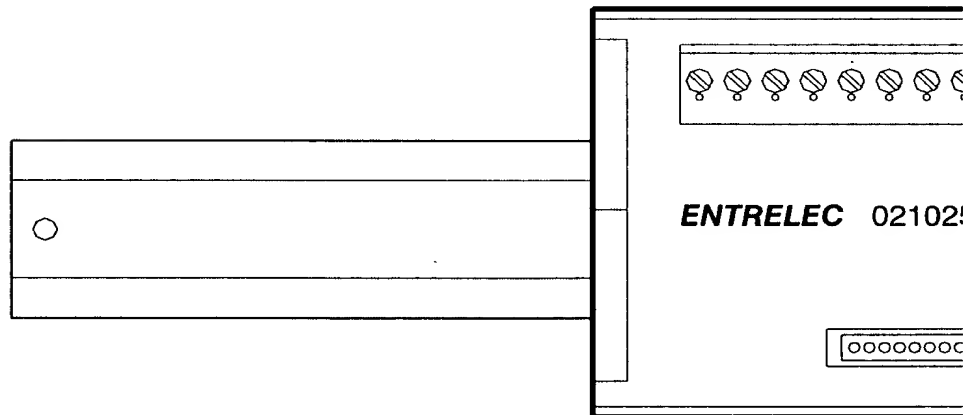
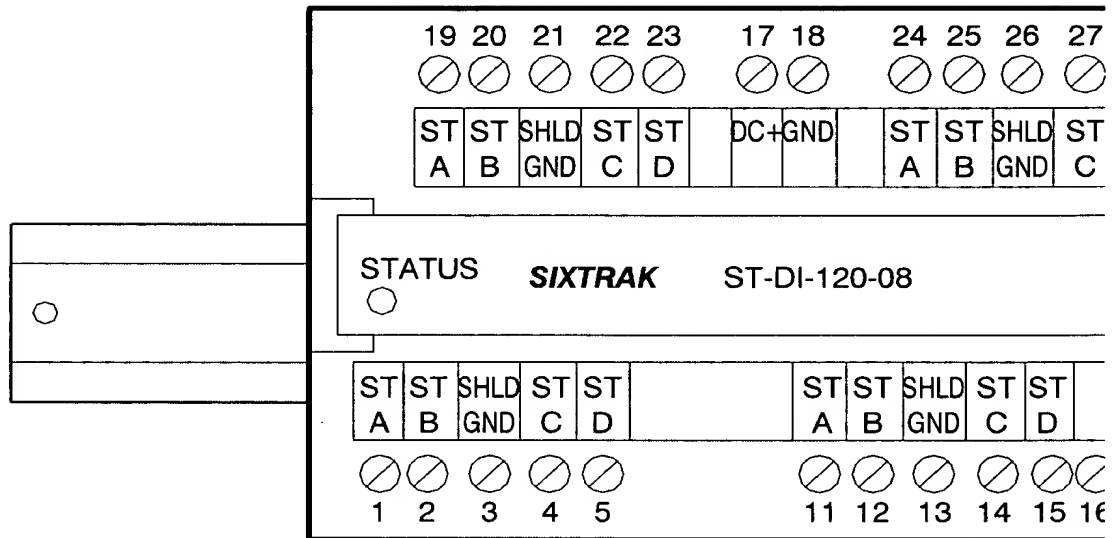
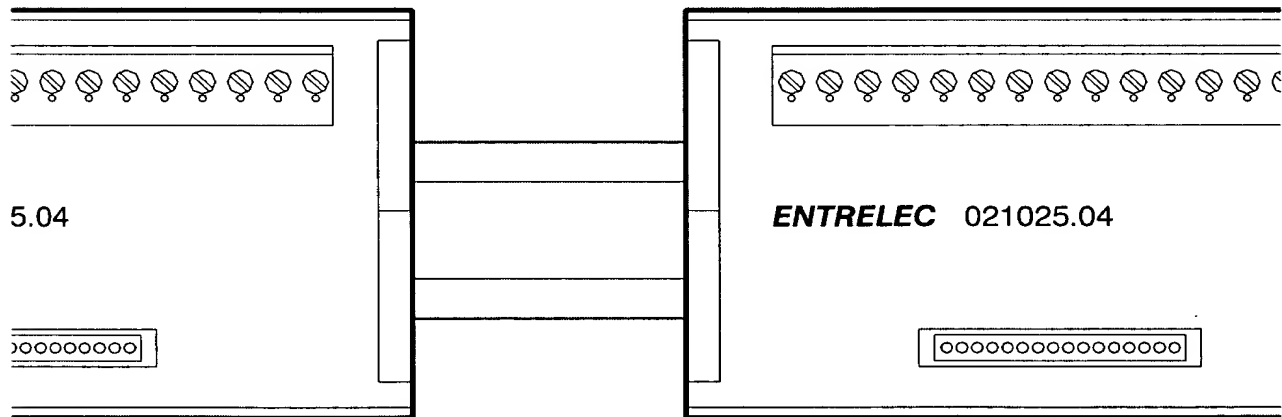
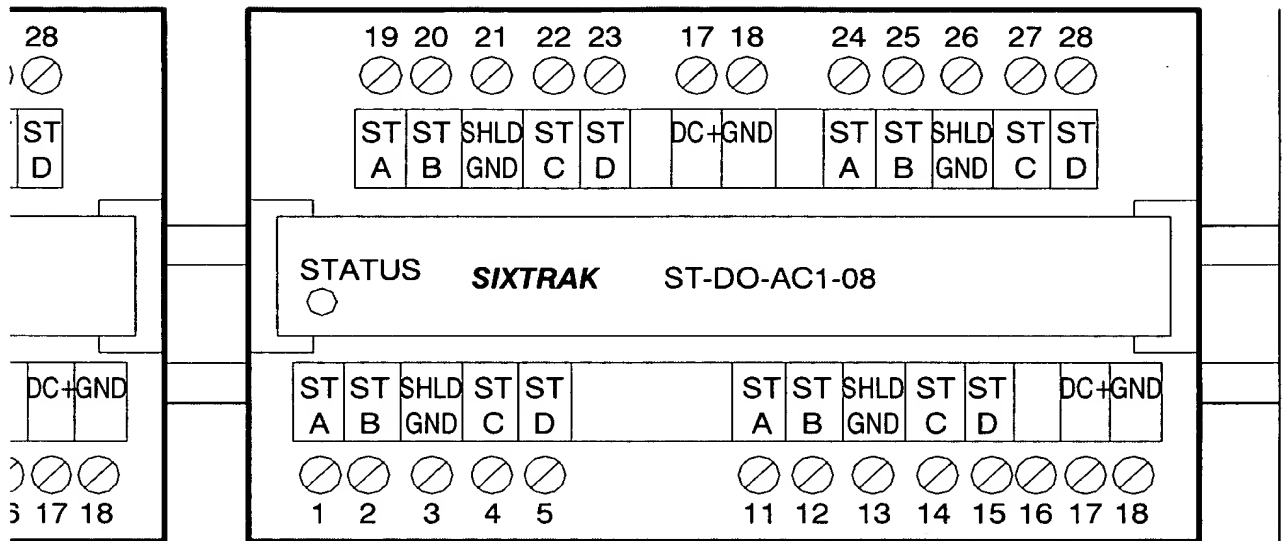


FIG. 4B-5



**FIG. 4B-6**

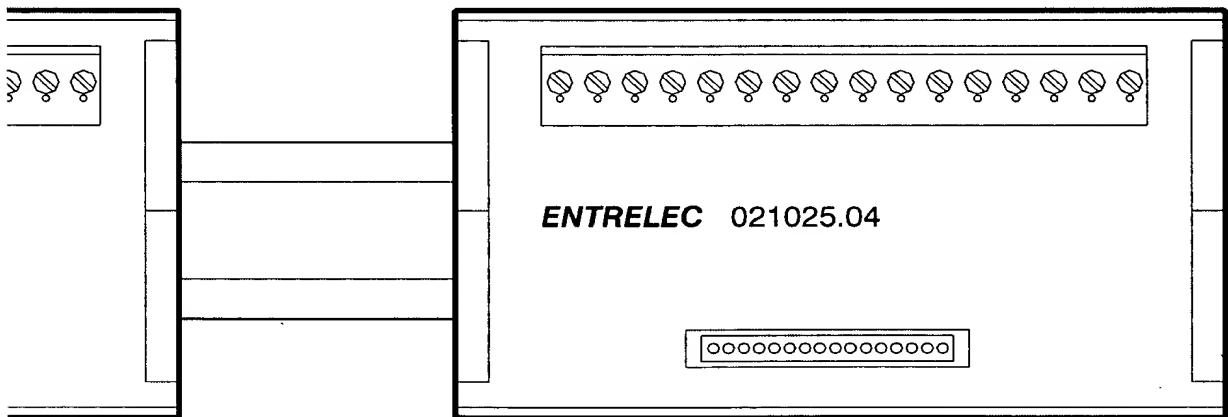
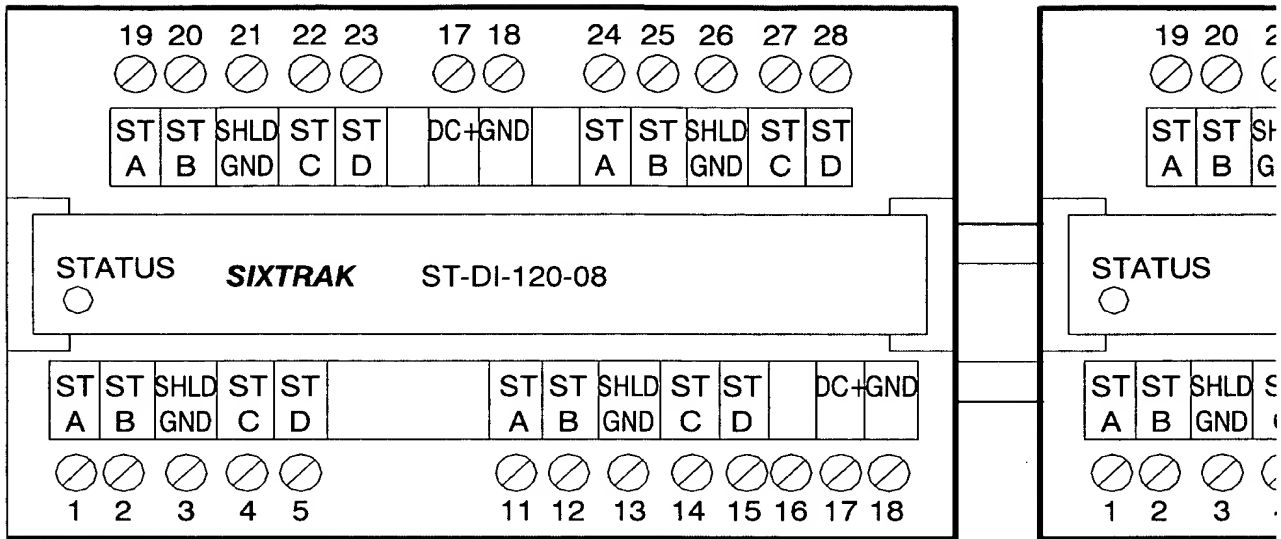


FIG. 4B-7

This image shows a blank sheet of white paper with horizontal ruling lines. A single vertical line runs down the right side of the page, creating a margin. The paper is oriented horizontally. There are no markings, text, or illustrations on the page.

<i>FIG. 5A-1</i>	<i>FIG. 5A-2</i>	<i>FIG. 5A-3</i>	<i>FIG. 5A-4</i>
<i>FIG. 5A-5</i>	<i>FIG. 5A-6</i>	<i>FIG. 5A-7</i>	<i>FIG. 5A-8</i>

***FIG. 5A******FIG. 5B***

<i>FIG. 5B-1</i>	<i>FIG. 5B-2</i>	<i>FIG. 5B-3</i>	<i>FIG. 5B-4</i>
<i>FIG. 5B-5</i>	<i>FIG. 5B-6</i>	<i>FIG. 5B-7</i>	<i>FIG. 5B-8</i>

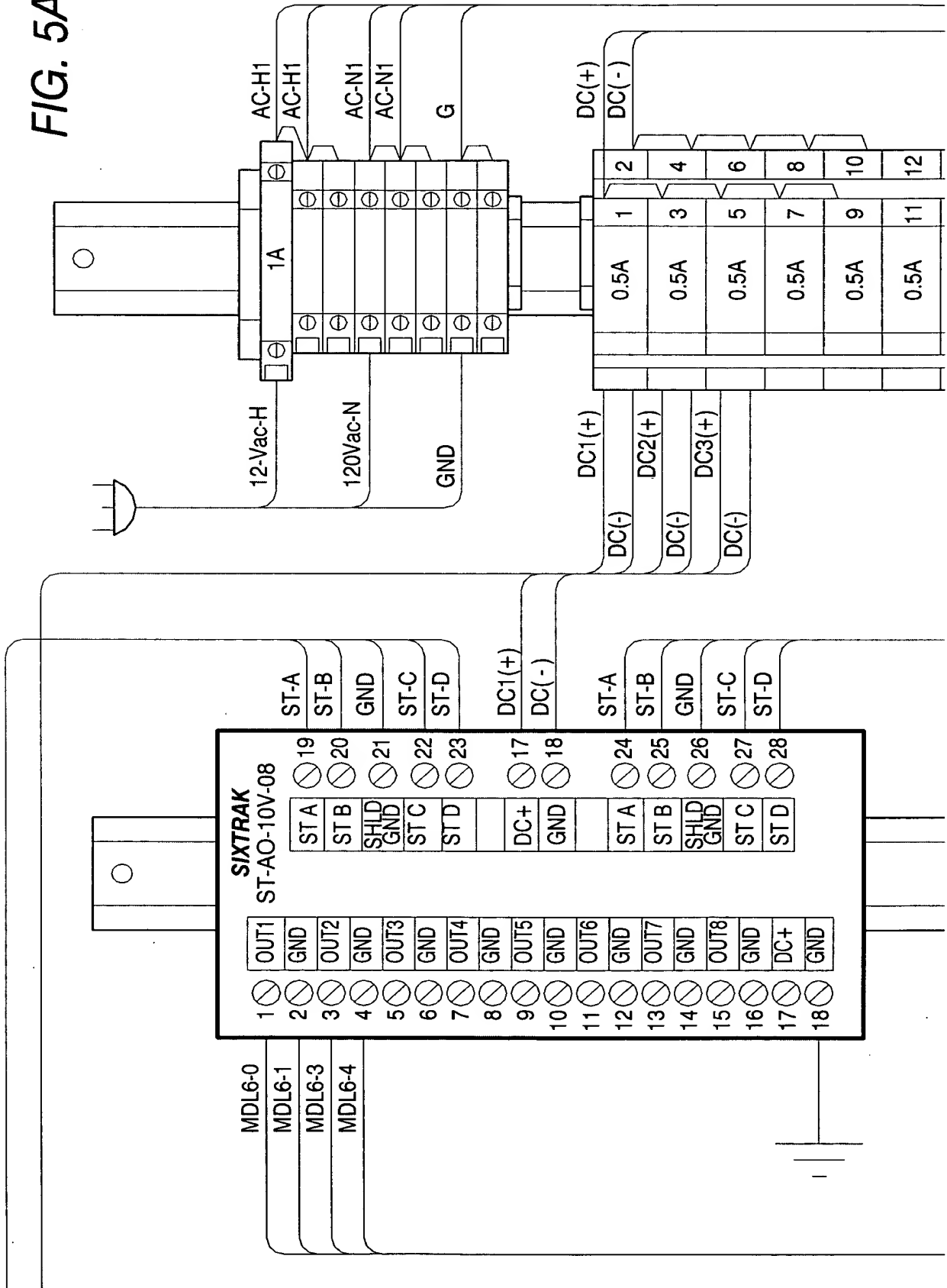


FIG. 5A-2

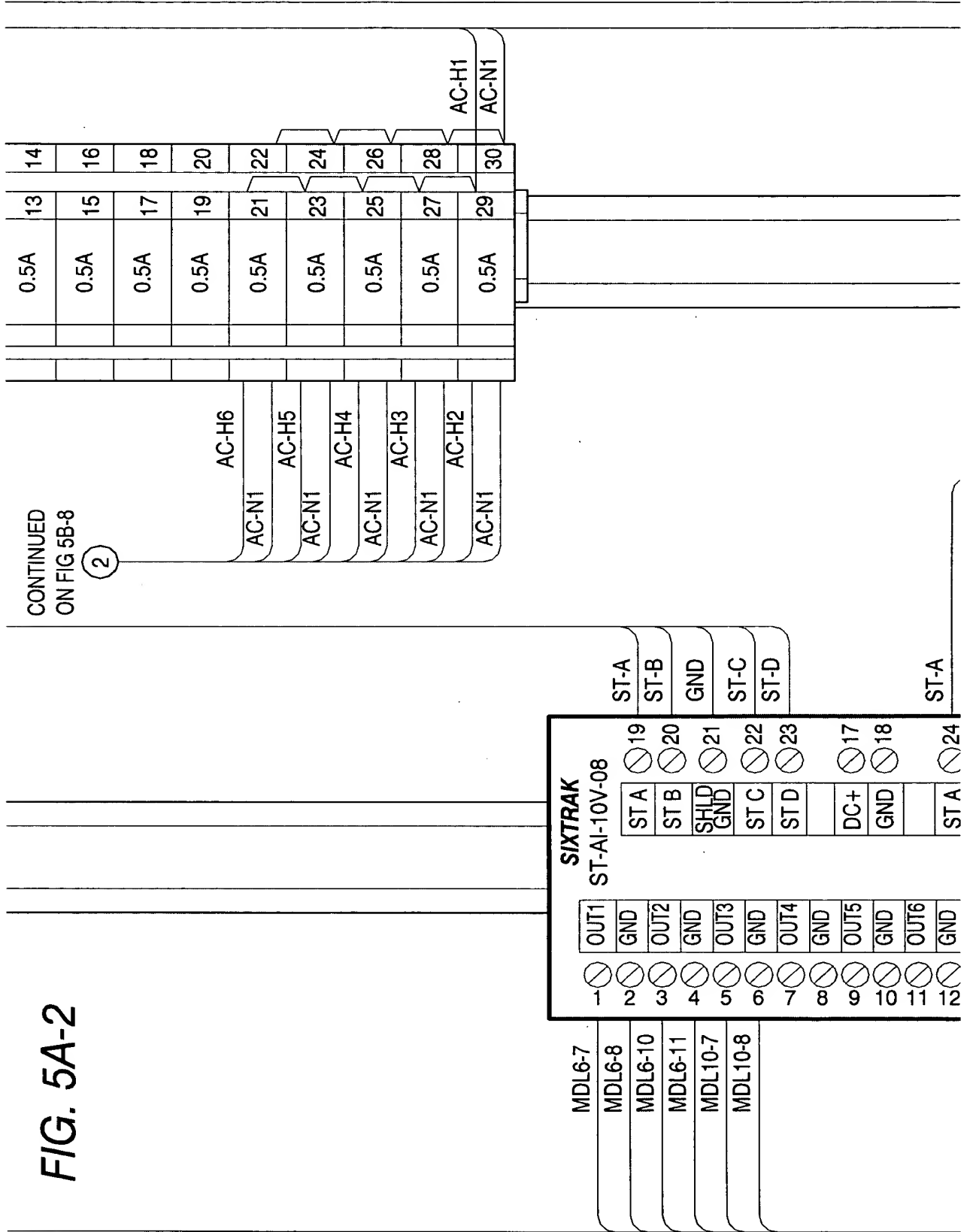
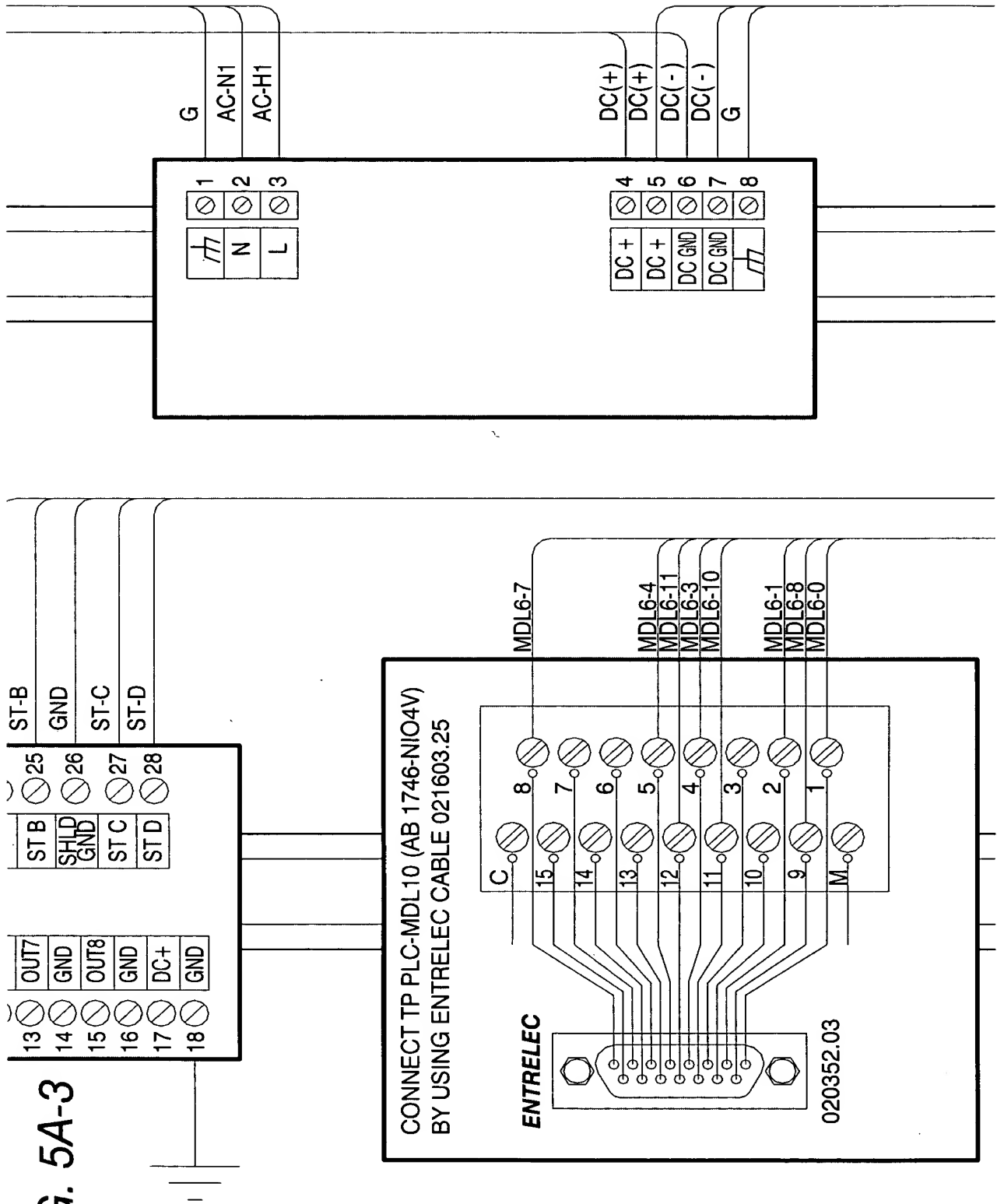
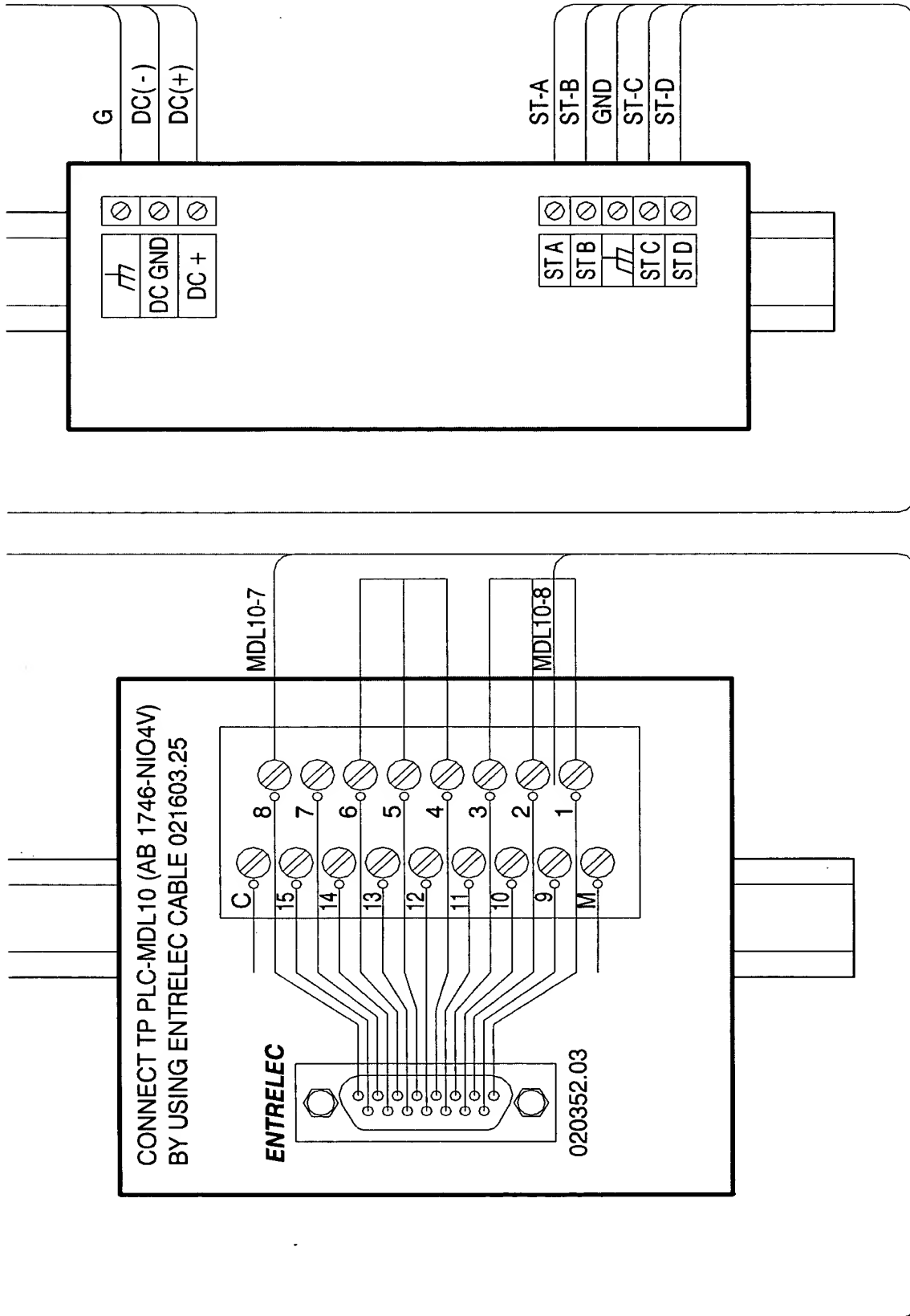


FIG. 5A-3

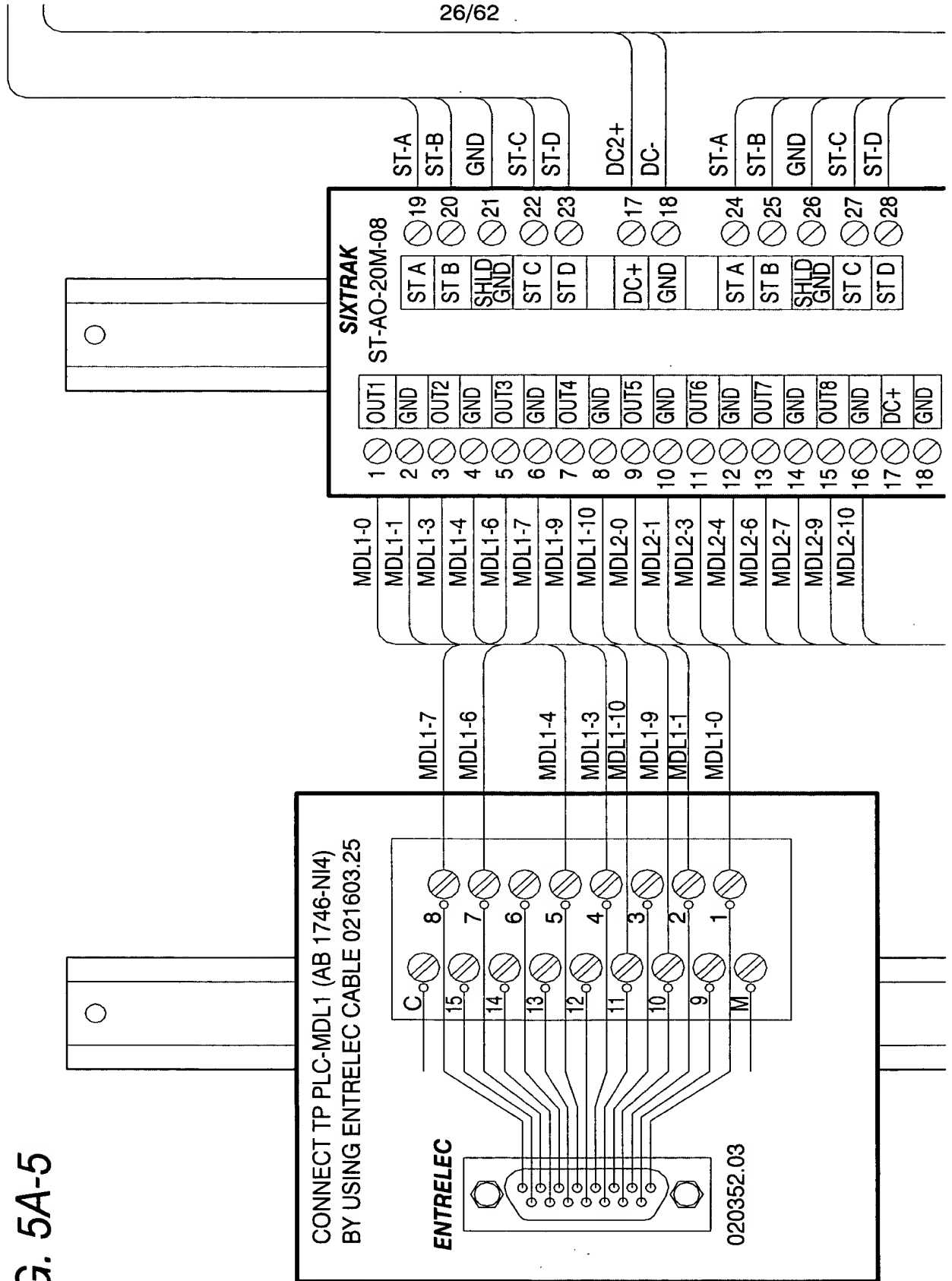






**FIG. 5A-4**

FIG. 5A-5



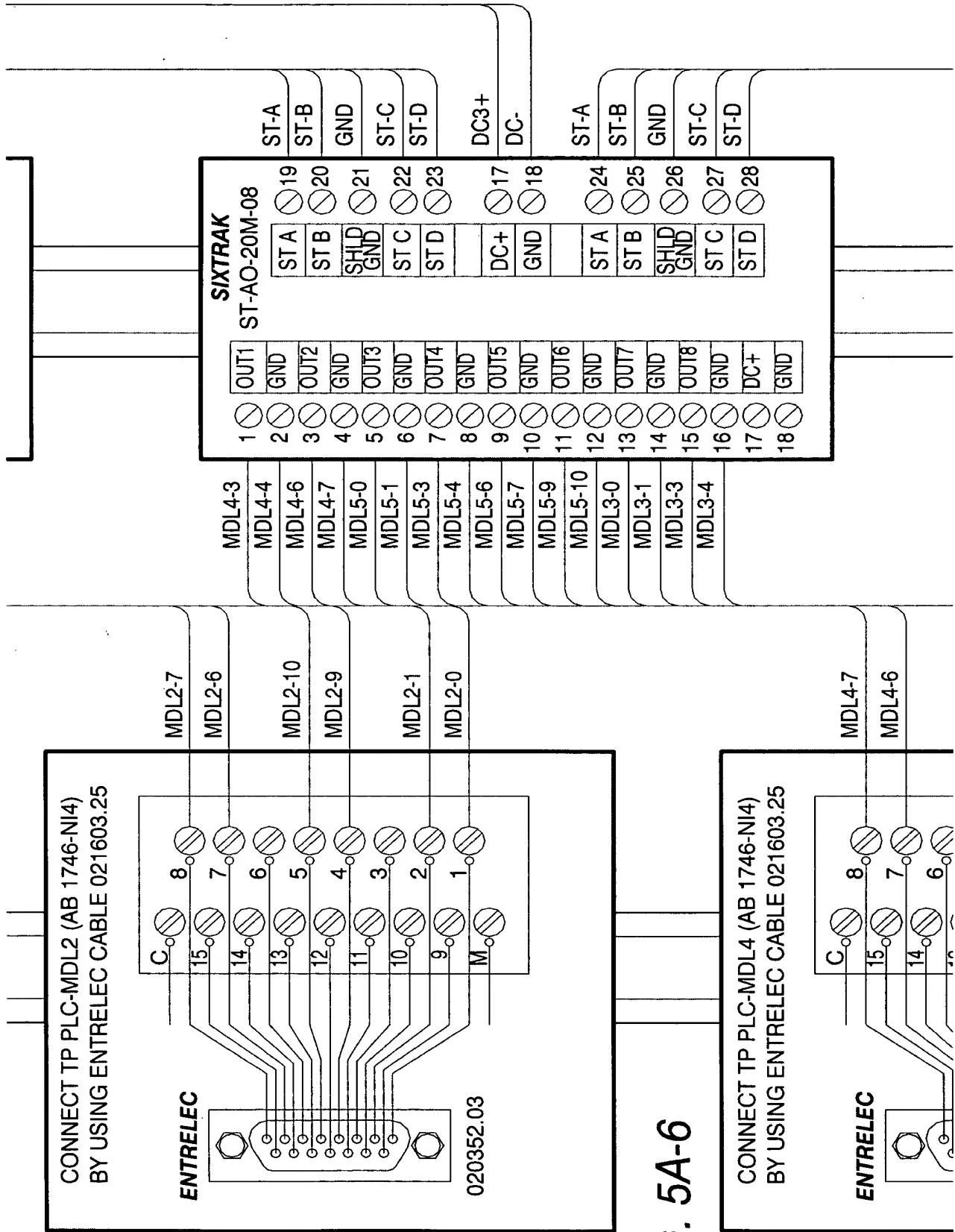
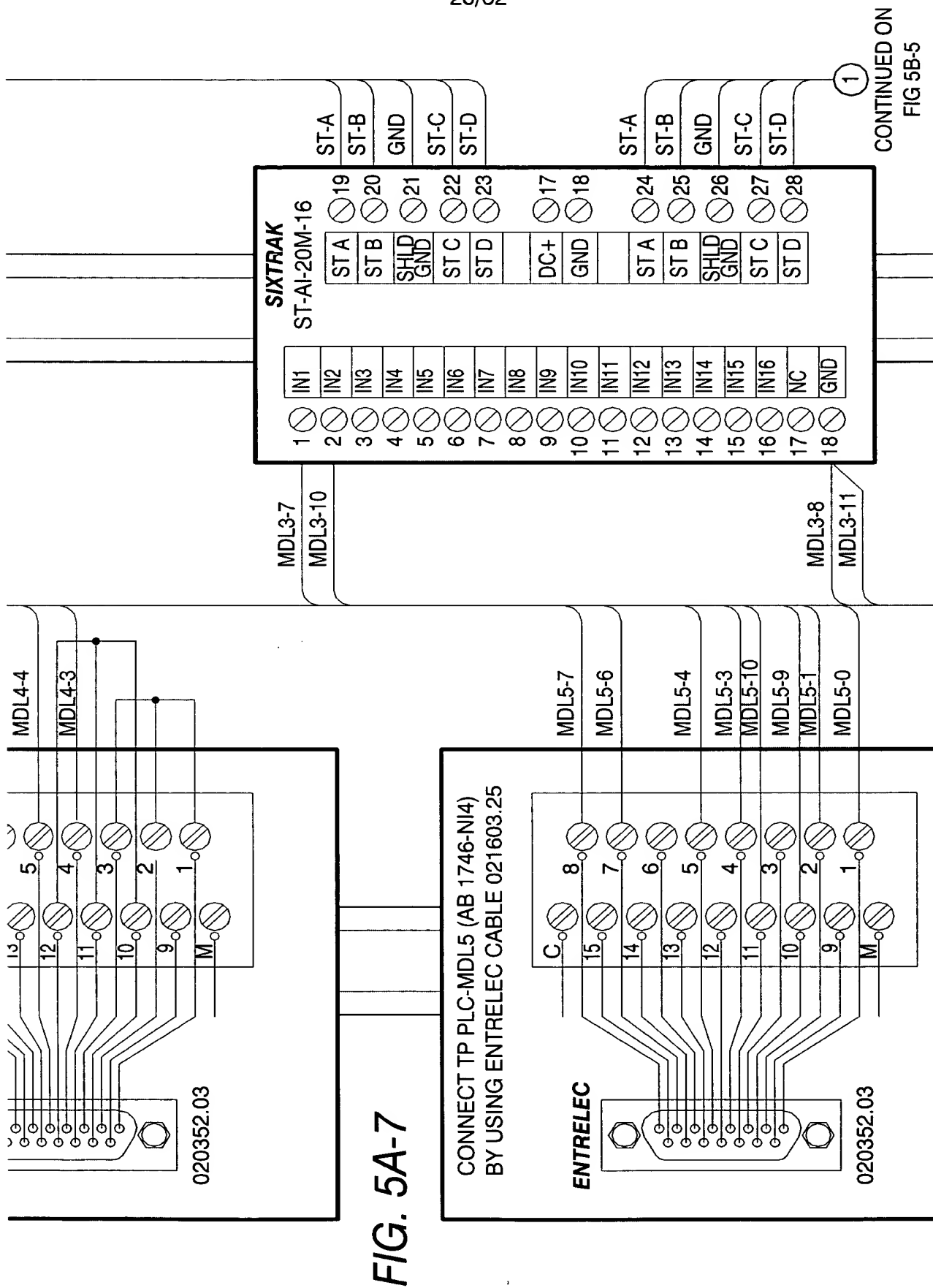


FIG. 5A-6



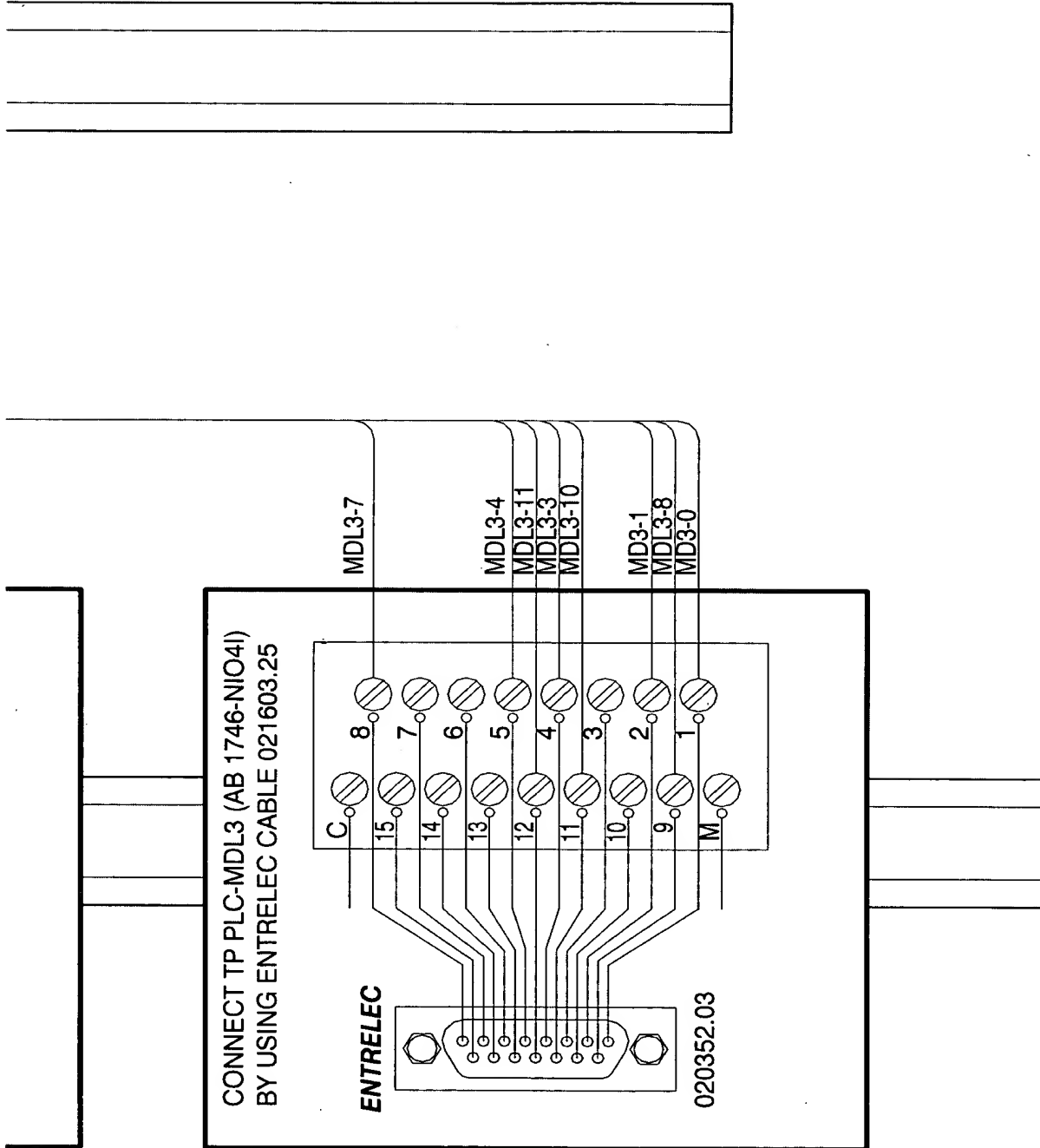
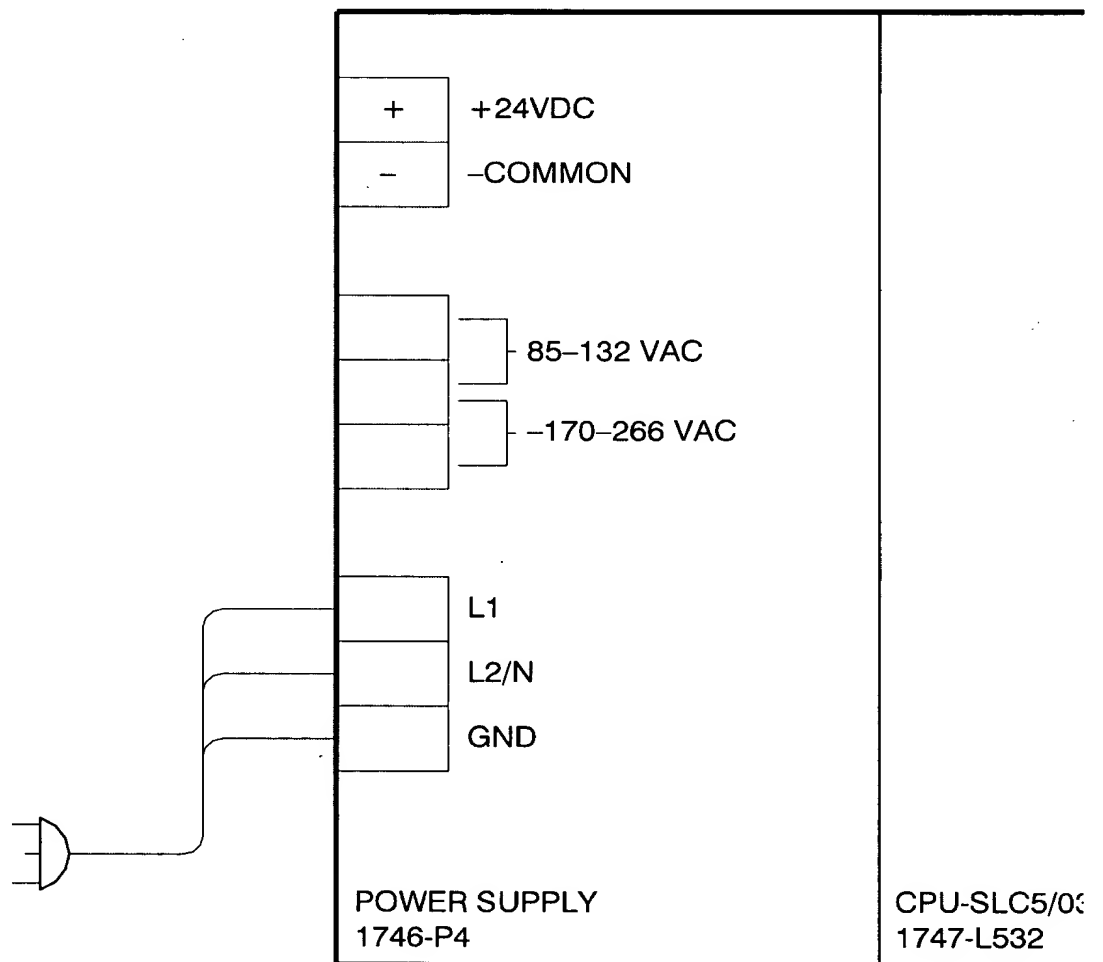


FIG. 5A-8

FIG. 5B-1



**FIG. 5B-2**

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	MODULE 1	MODULE 2	MODULE 3	MODULE 4	MODULI
3	AI (4-20mA) 1746-NI4	AI (4-20mA) 1746-NI4	AI/AO (4-20mA) 1746-NIO4I	AI (4-20mA) 1746-NI4	AI (4-20mA) 1746-NI4

FIG. 5B-3

≡ 5	MODULE 6	MODULE 7	MODULE 8	MODULE 9	MODU
∪	AI/AO (0-5V) 1746-NIO4V	DI/DO (RELAY) 1746-IO12	DI/DO (RELAY) 1746-IO12	DI/DO (RELAY) 1746-IO12	AI/AO (0 1746-NIO



*FIG. 5B-4*

JE 10	MODULE 11	MODULE 12
-5V) 04V	THERMOCOUPLE 1746-NT4	SCANNER 1746-SN

FIG. 5B-5

CONTINUED ON  
FIG. 5A-7

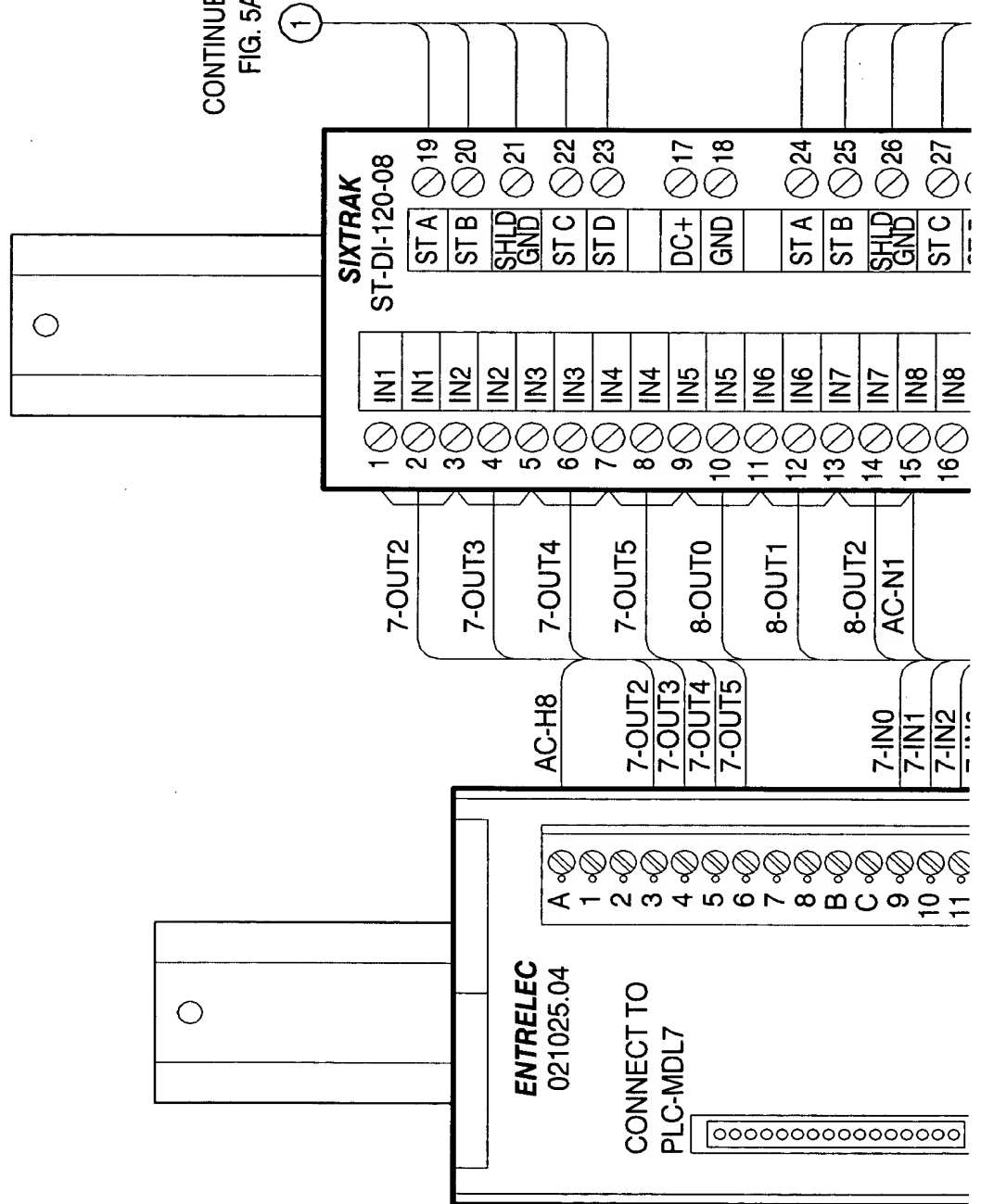


FIG. 5B-6

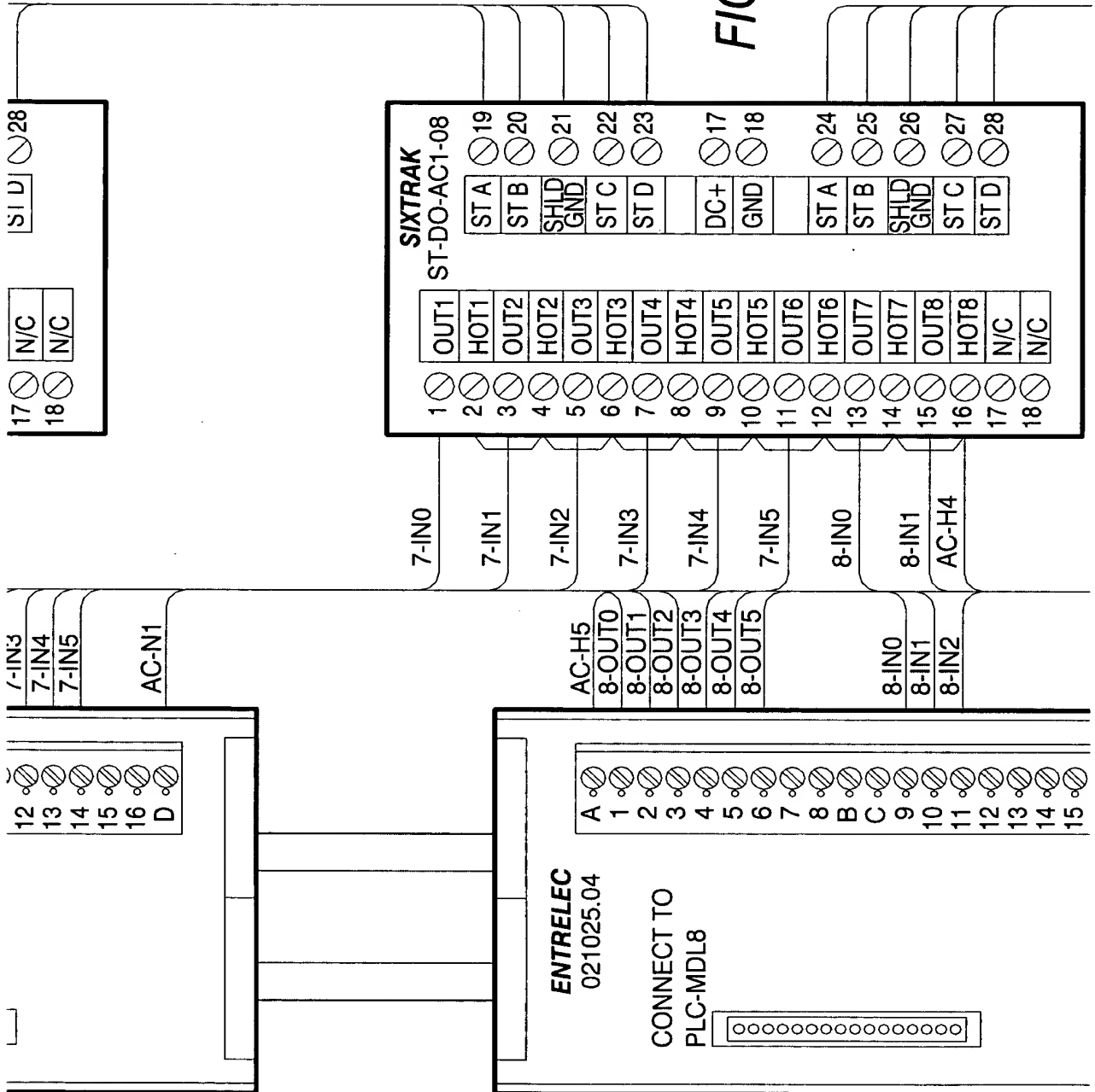
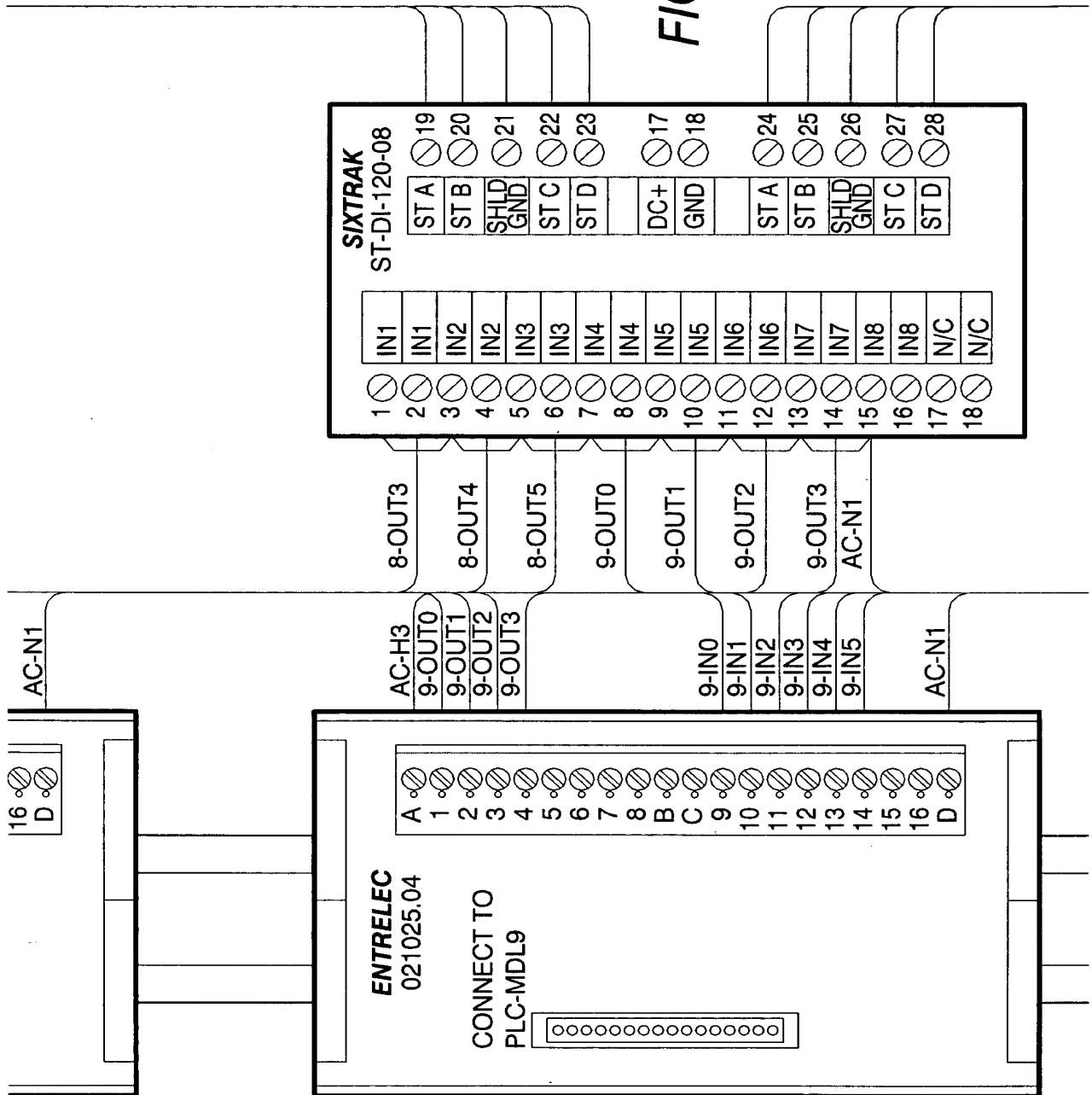


FIG. 5B-7



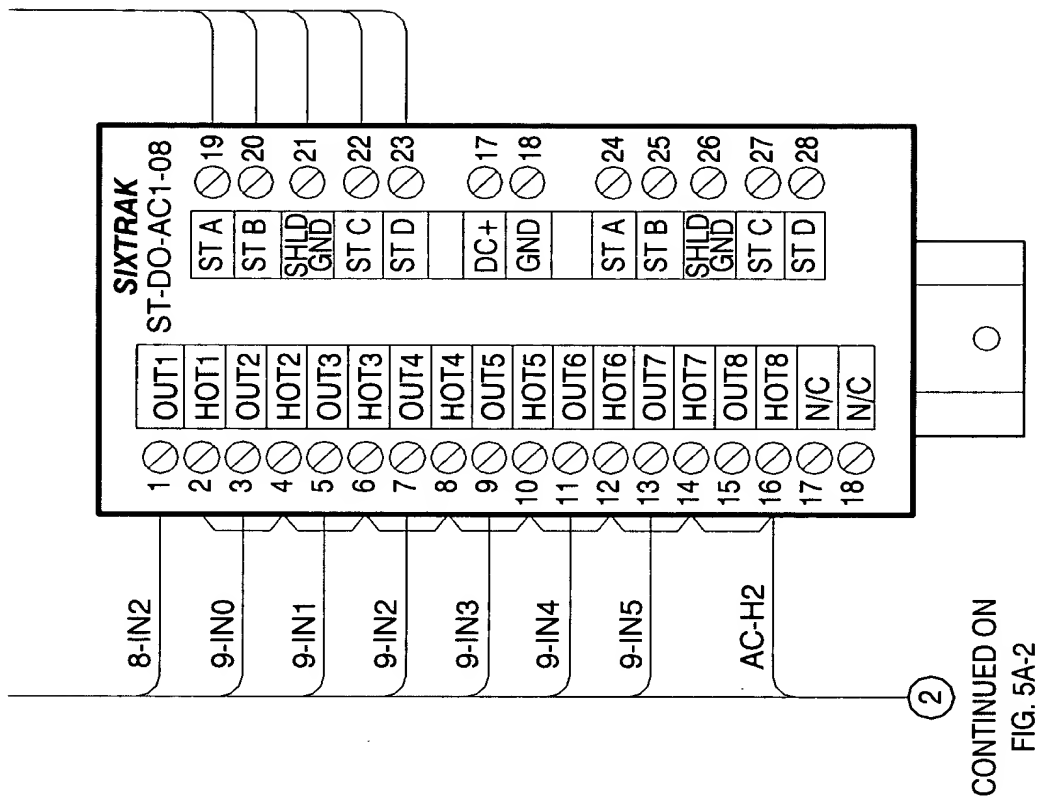


FIG. 5B-8

<i>FIG. 6-1</i>	<i>FIG. 6-2</i>	<i>FIG. 6-3</i>	<i>FIG. 6-5</i>
<i>FIG. 6-5</i>	<i>FIG. 6-6</i>	<i>FIG. 6-7</i>	<i>FIG. 6-8</i>

*FIG. 6*

FIG. 6-1

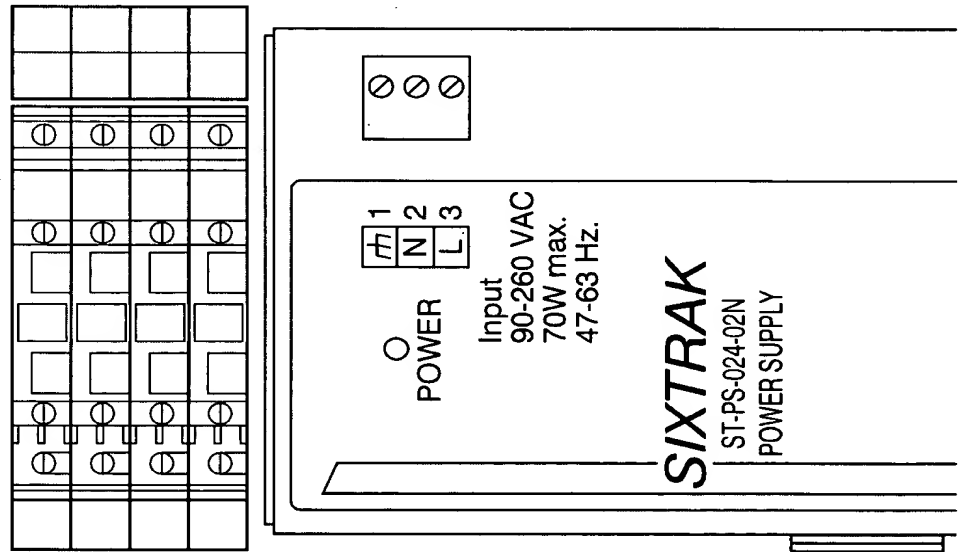
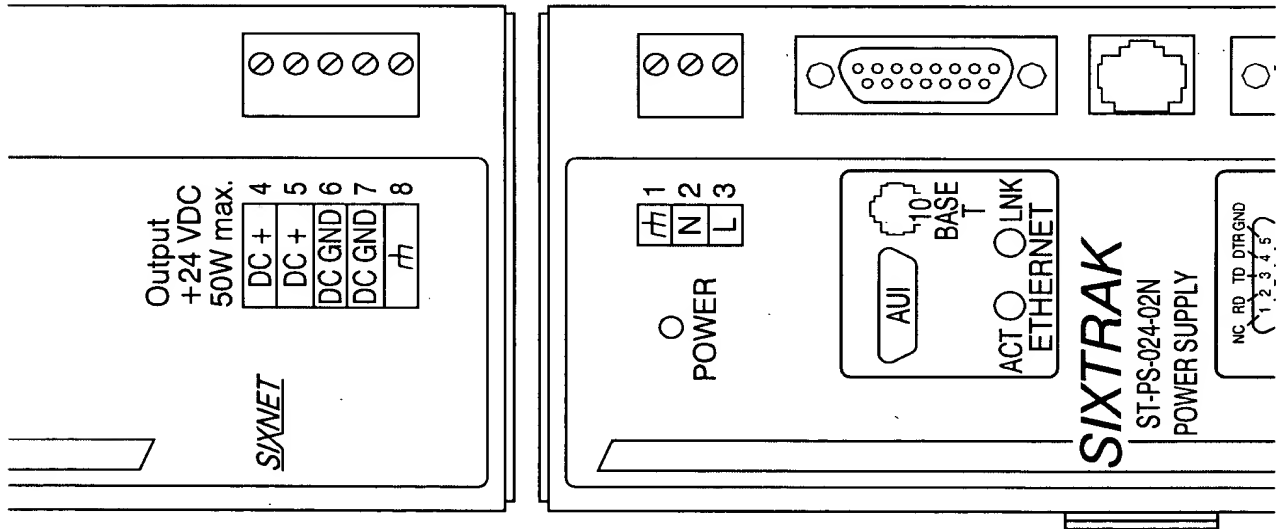


FIG. 6-2





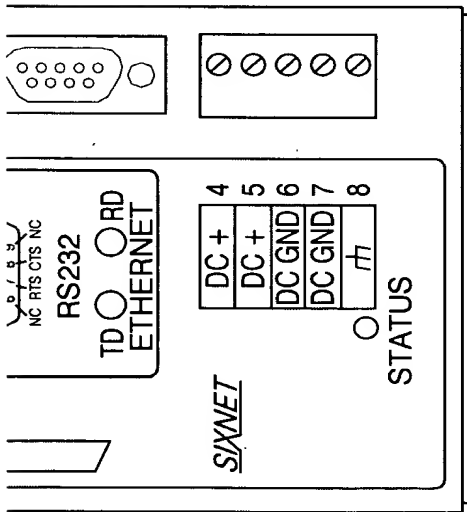


FIG. 6-3

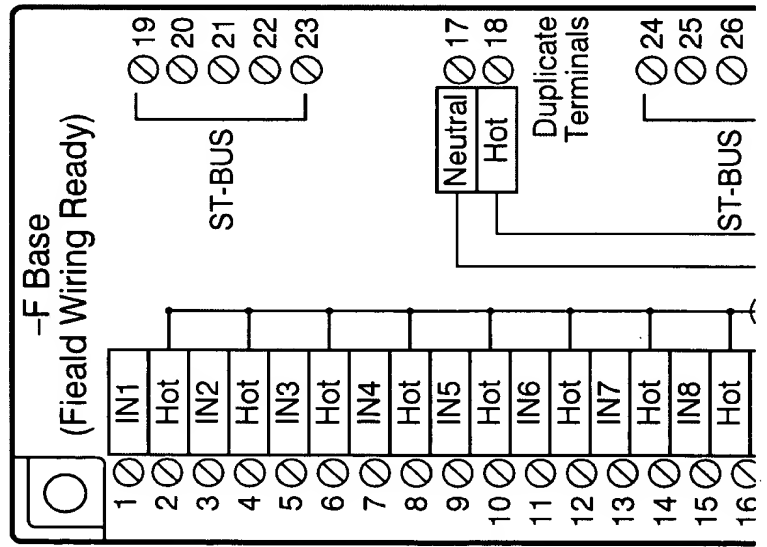


FIG. 6-4

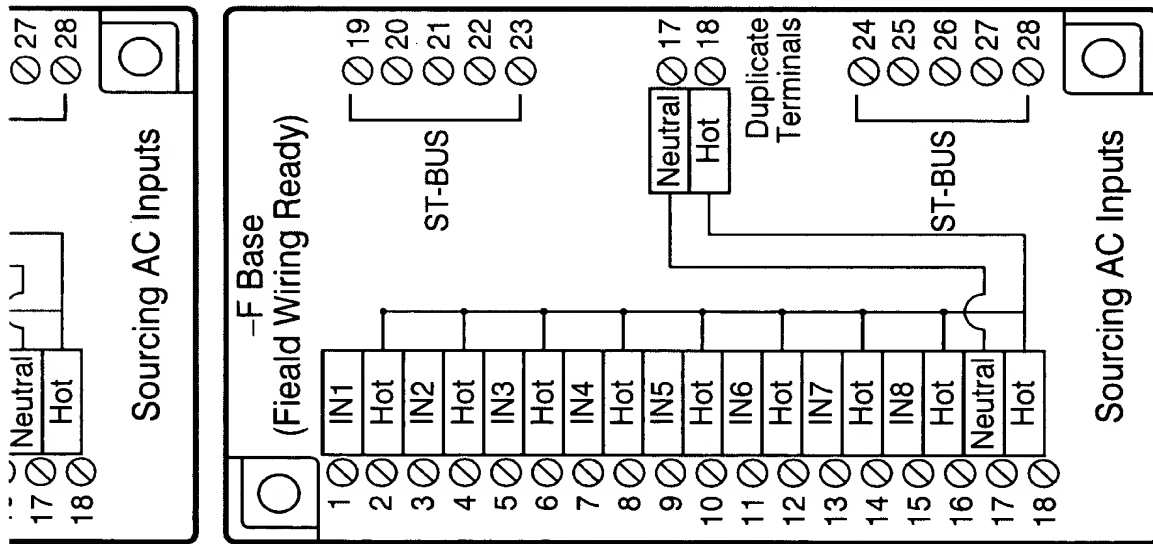
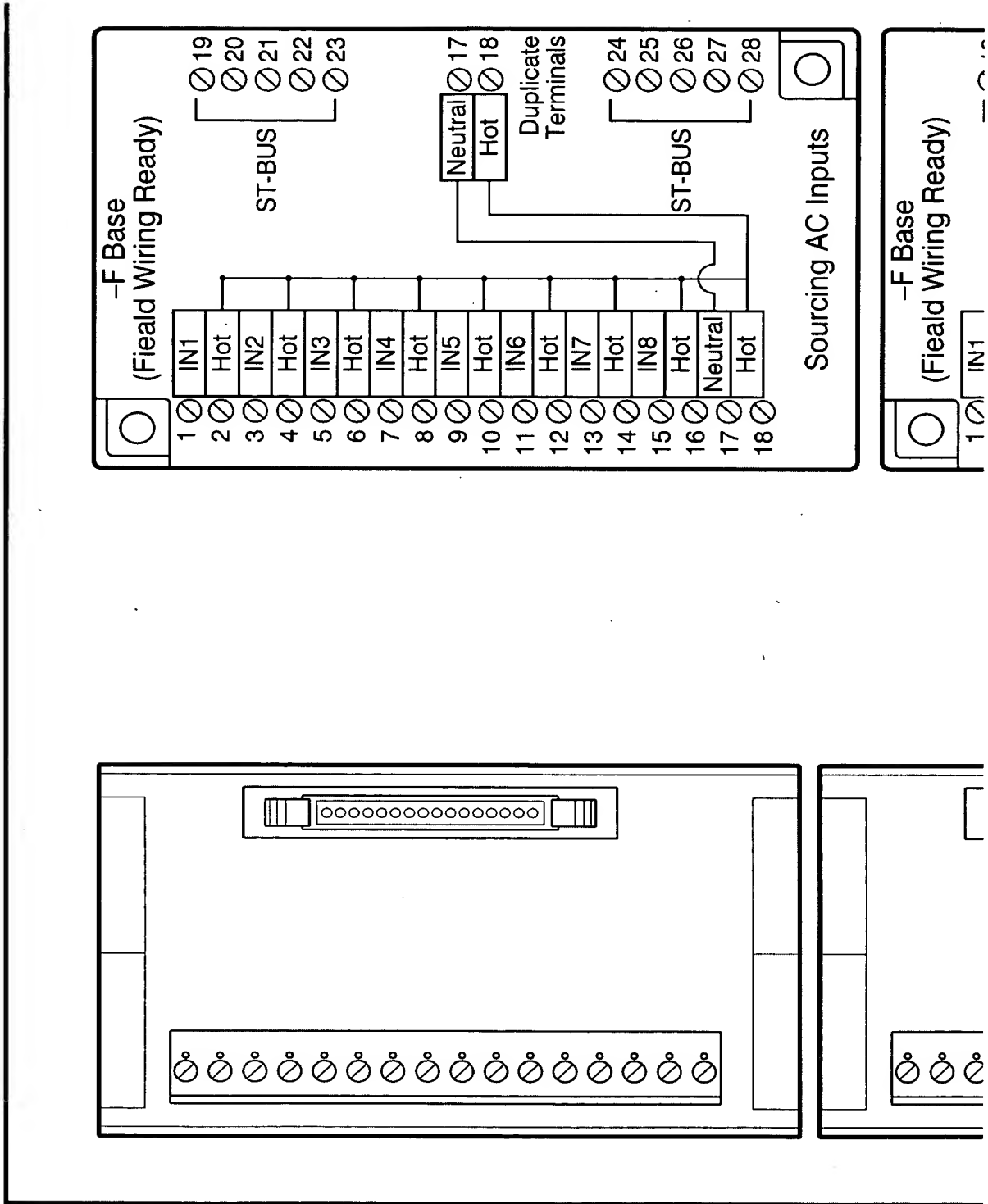


FIG. 6-5



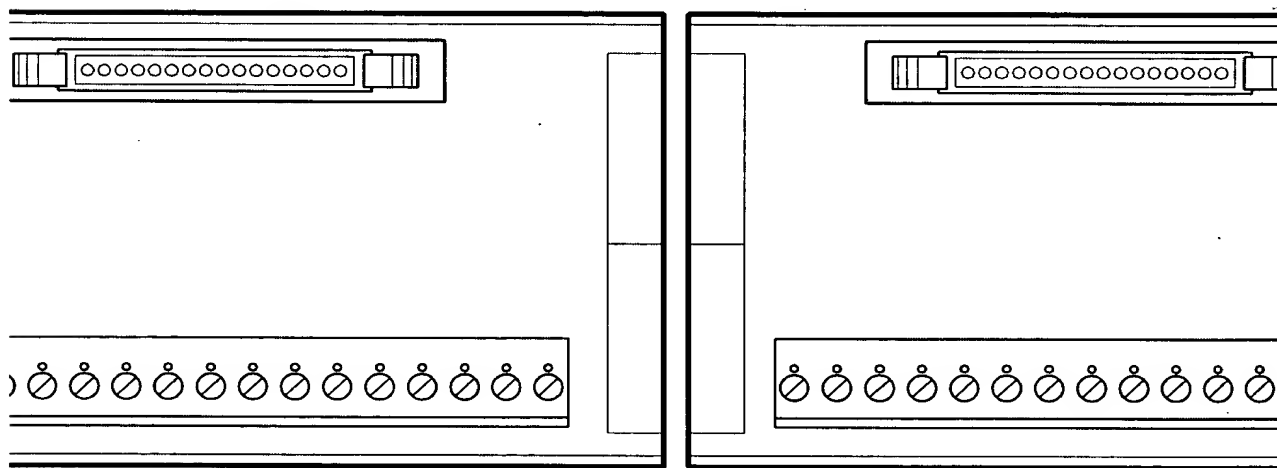
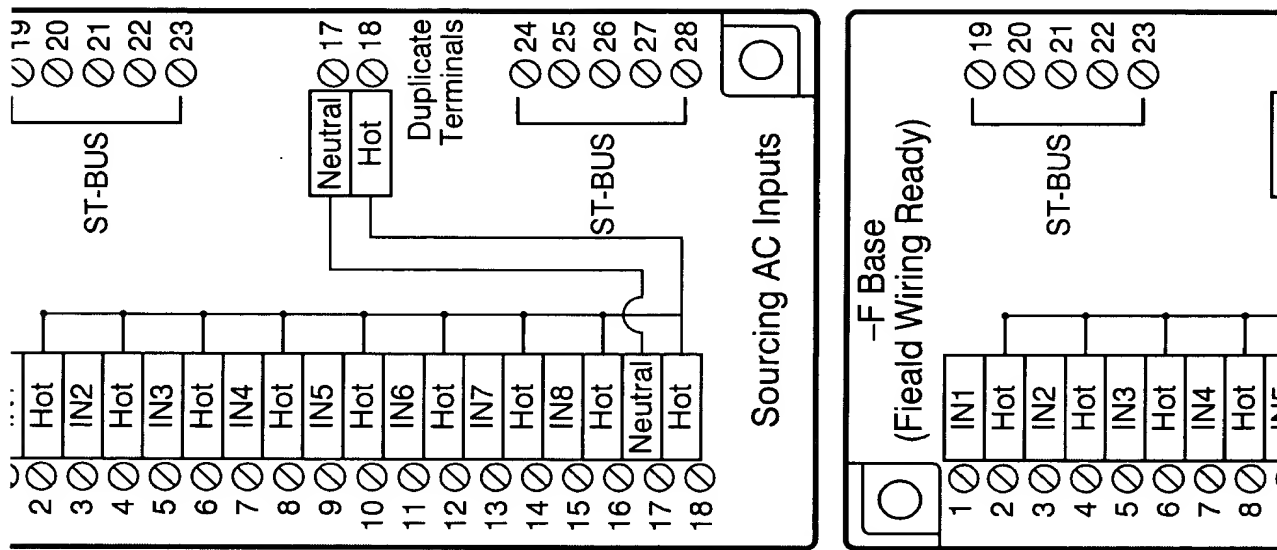


FIG. 6-6

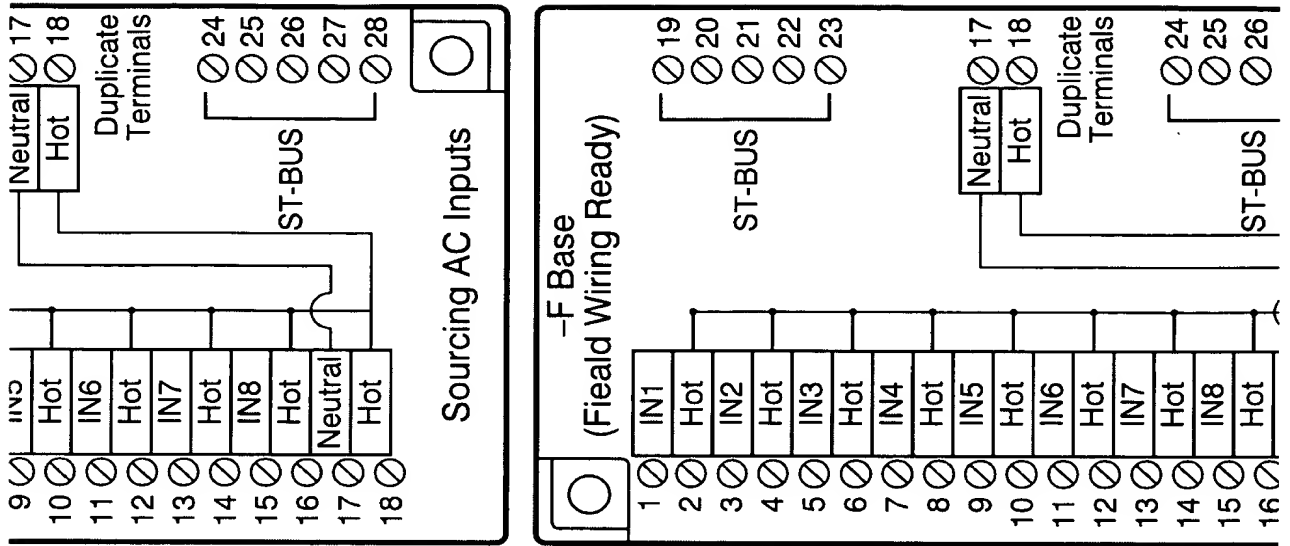
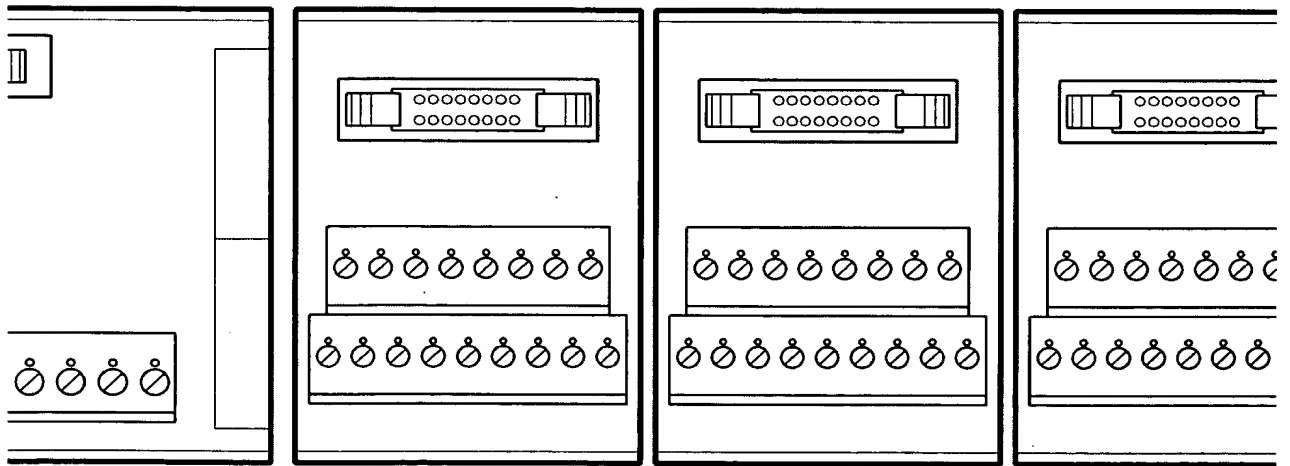


FIG. 6-7



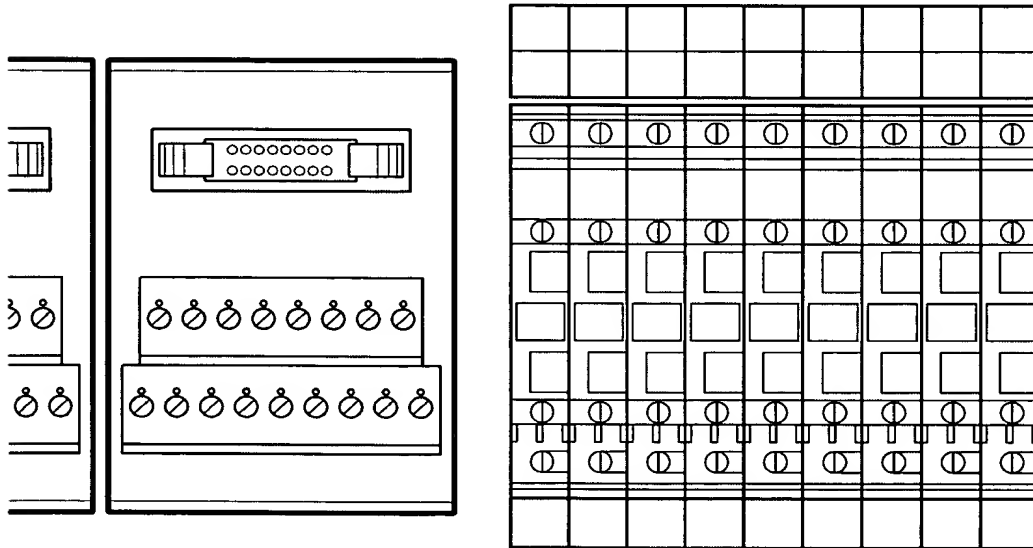
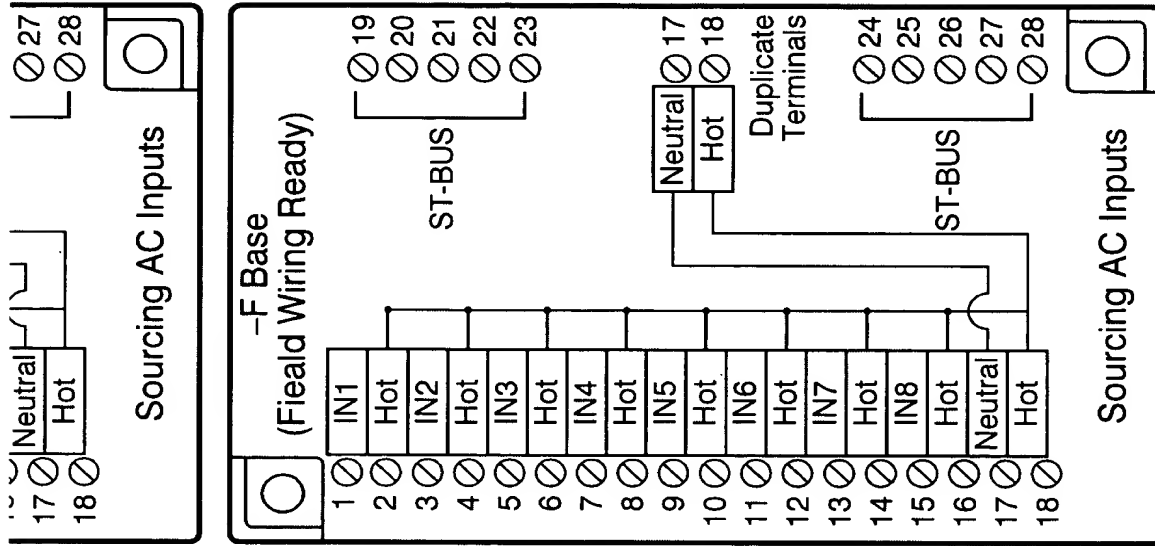


FIG. 6-8

*FIG. 7*

Select Test Section to Run

General	▲ ▼
Input Manifold	
Filtration	
Column Separation	
Output Manifold	

RUN TEST CANCEL

*FIG. 8*

Partially complete procedure: Select Starting Test Setup

<START FROM BEGINNING>		▲ ▼
1 I: Select PID test from test	Q: Was the test successfully	
2 I: Select Totalizer test fro	Q: Was the test successfully	
3 I: Select Indication test fr	Q: Was the test successfully	
4 I: Select Indication test fr	Q: Was the test successfully	

RUN TEST CANCEL

FIG. 9

Running Test...

Step 3.1

Select PID test from test module menu. Run test for FIC\_2001\_01.

DONE

Was the test successfully completed?

YESCOMMENTNO

PREV STEPCURR STEP1 of 8NEXT STEP

DebugReset BitSet BitCANCELCLOSE



FIG. 10

Running Test...

Step 3.1

Select PID test from test module menu.  
Run test for FIC\_2001\_01.

DONE

Was the test successfully  
completed?

YES

COMMENT

NO

PREV STEP

CURR STEP

1 of 8

NEXT STEP

Debug

Reset Bit

Set Bit

CANCEL

CLOSE

FIG. 11

Running Test...

Step 3.2

Select Totalizer test from test module menu. Run test for FQIT\_2001\_01.

DONE

Was the test successfully completed?

YESCOMMENTNO

PREV STEPCURR STEP2 of 8NEXT STEP

DebugReset BitSet BitCANCELCLOSE

TagName	Initial	LL_Limit	L_Limit	H_Limit	HH_Limit	Deadband
PT_2001_01	1				59.00	
PT_2001_02	1		40.00		42.00	
PT_2001_03	1	15.00			30.00	

FIG. 12

FIG. 13

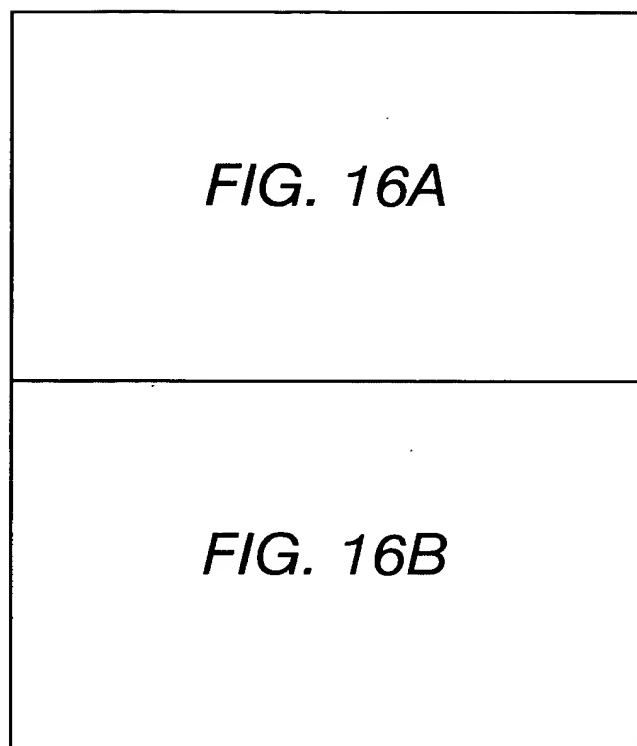
Alm_Ind	Qnum	Type	Question
A1	1H		Did the analog display symbol flash RED on screen?
A1	1H_DB		Is the alarm still active?
A1	1H_RTN		Did the HIGH level alarm clear?
D1	1Dig		Did the alarm activate?
D1	1Dig_RTN		Did the alarm reset?
A1	1L		Did the analog display symbol flash RED on screen?
A1	1L_DB		Is the alarm still active?
A1	1L_RTN		Did the LOW level alarm clear?
A1	2H		Did the menu button for the display screen flash?
A1	2L		Did the menu button for the display screen flash?
A1	3H		Did the alarm text appear on "CURRENT ALARMS"?
A1	4H		Did the SCADA Alarm paging system receive the alarm? (F12for System

ID	TagName	Description	EUZero	EUMax	Eunit
	AIT_2001_01	Column Exit	2	12	pH
	AIT_2001_02	Column Exit	0	200	mmho
	AIT_2001_03	Column Exit	0	30	AU
	AIT_2001_04	Column Inlet	0	30	AU
	AIT_2001_05	Column Inlet	2	12	pH
	AIT_2001_06	Column Inlet	0	200	mmho
	PT_2001_01	Filter Inlet	0	60	psig
	PT_2001_02	Column Inlet	0	60	psig
	PT_2001_03	Column Exit	0	60	psig
	TT_2001_01	Feed	0	50	deg C
	TT_2001_02	Column Exit	0	50	deg C

FIG. 14

FIG. 15

PID Number	Loop Desc	Process TagName	Min EU	Max EU	EU Name	SetPoint TagName	Control
1	Controls filter	dP_2001_02	0	5	V	PT_2001_02	dPC_20
2		FIT_2001_01	0	15	L/min	FIC_2001_01SP	FIC_20

**FIG. 16****FIG. 17**

Num	Name
1	General
2	Input Manifold
3	Filtration
4	Column
5	Output

FIG. 16A

ID	SectionNum	SectionStep	Instruction	
	2	20	Click on "Test" button and select tag name XV_2001_105_ZCO and read	W
	2	21	From HMI open valve 106.	
	2	22	Click on "Test" button and select tag name XV_2001_106_ZCO and read	W
	2	23	From HMI open valve 106.	
	2	24	Click on "Test" button and select tag name XV_2001_106_ZCO and read	W
	2	25	From HMI open valve 107.	
	2	26	Click on "Test" button and select tag name XV_2001_107_ZCO and read	W
	2	27	From HMI close valve 107.	
	2	28	Click on "Test" button and select tag name XV_2001_107_ZCO and read	W
	2	29	From HMI open valve 108.	
	2	30	Click on "Test" button and select tag name XV_2001_108_ZCO and read	W
	2	31	From HMI close valve 108.	
	2	32	Click on "Test" button and select tag name XV_2001_108_ZCO and read	W
	2	33	From HMI open valve 109.	
	2	34	Click on "Test" button and select tag name XV_2001_109_ZCO and read	W
	2	35	From HMI close valve 109.	
	2	36	Click on "Test" button and select tag name XV_2001_109_ZCO and read	W
	2	37	From HMI open valve 110.	
	2	38	Click on "Test" button and select tag name XV_2001_110_ZCO and read	W
	2	39	From HMI close valve 110.	
	1	1	Instauction 1	Q
	2	1	From HMI open valve 101.	
	2	2	Click on "Test" button and select tag name XV_2001_101_ZCO and read	W
	2	3	From HMI close valve 101.	
	2	4	Click on "Test" button and select tag name XV_2001_101_ZCO and read	W
	2	5	From HMI open valve 102.	

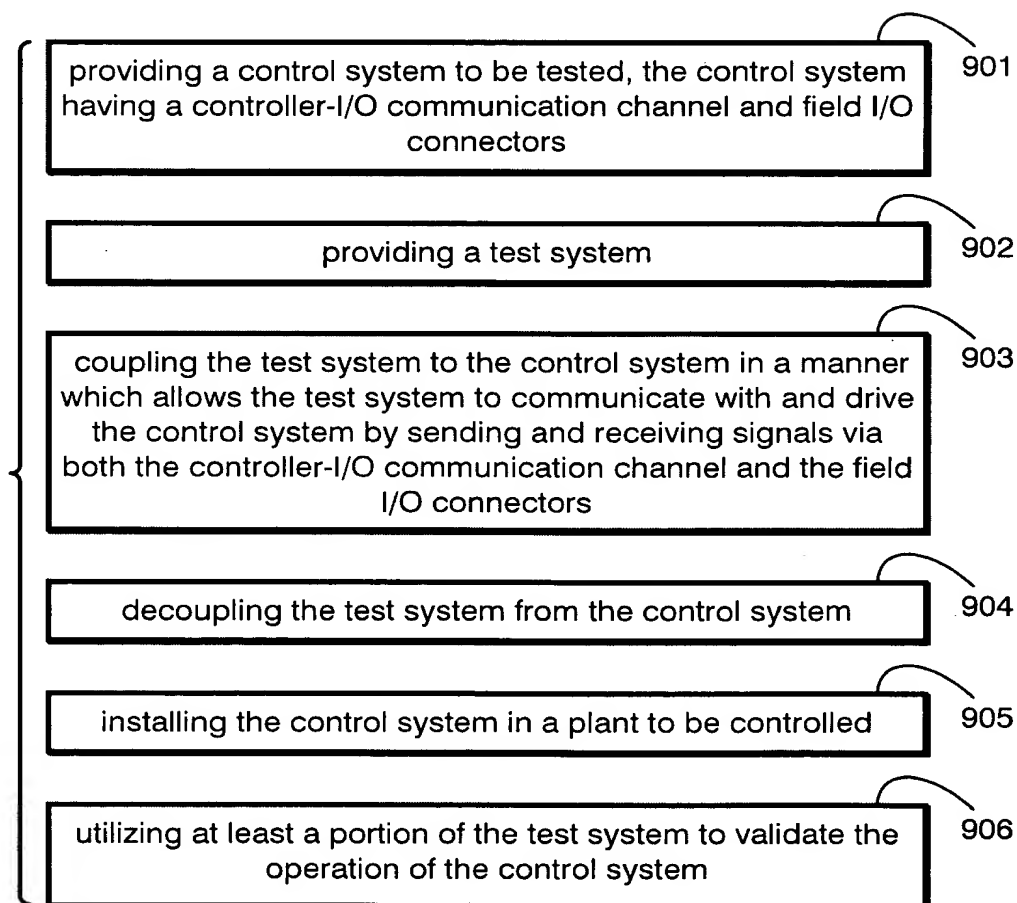
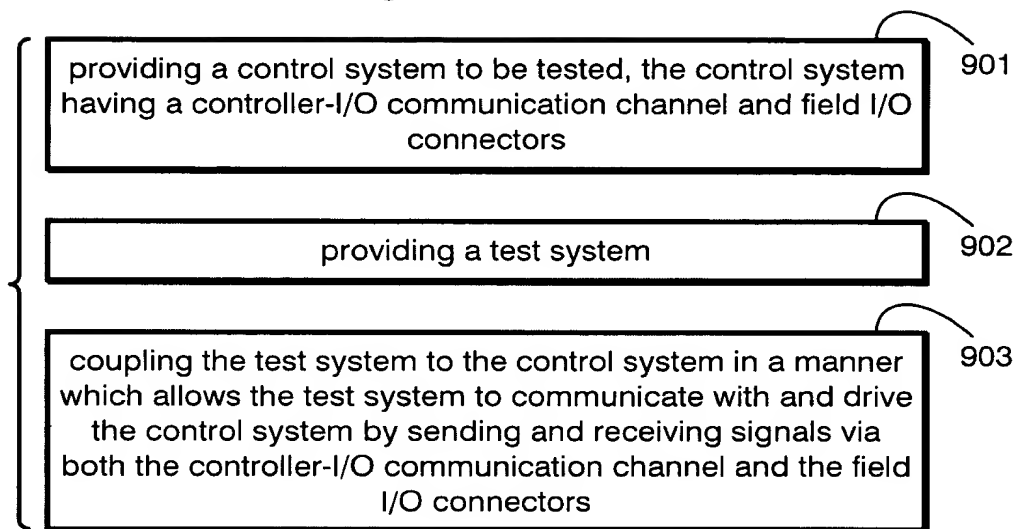
	2	6	Click on "Test" button and select tag name XV_2001_102_ZCO and read	W
	2	7	From HMI close valve 102.	
	2	8	Click on "Test" button and select tag name XV_2001_102_ZCO and read	W
	2	9	From HMI open valve 103.	
	2	10	Click on "Test" button and select tag name XV_2001_103_ZCO and read	W
	2	11	From HMI close valve 103.	
	2	12	Click on "Test" button and select tag name XV_2001_103_ZCO and read	W
	2	13	From HMI open valve 104.	
	2	14	Click on "Test" button and select tag name XV_2001_104_ZCO and read	W
	2	15	From HMI close valve 104.	
	2	16	Click on "Test" button and select tag name XV_2001_104_ZCO and read	W
	2	17	From HMI open valve 105.	
	2	18	Click on "Test" button and select tag name XV_2001_105_ZCO and read	W
	2	19	From HMI close valve 105.	
	2	40	Click on "Test" button and select tag name XV_2001_110_ZCO and read	W
	3	1	Select PID test from test module menu. Run test for FQIT_2001_01.	W
	3	2	Select Totalizer test from test module menu. Run test for FQIT_2001_01.	W
	3	3	Select Indication test from test module menu. Run test for FQIT_2001_01.	W
	3	4	Select Indication test from test module menu. Run test for TT_2001_01.	W
	3	5	Select Indication test from test module menu. Run test for PT_2001_01.	W

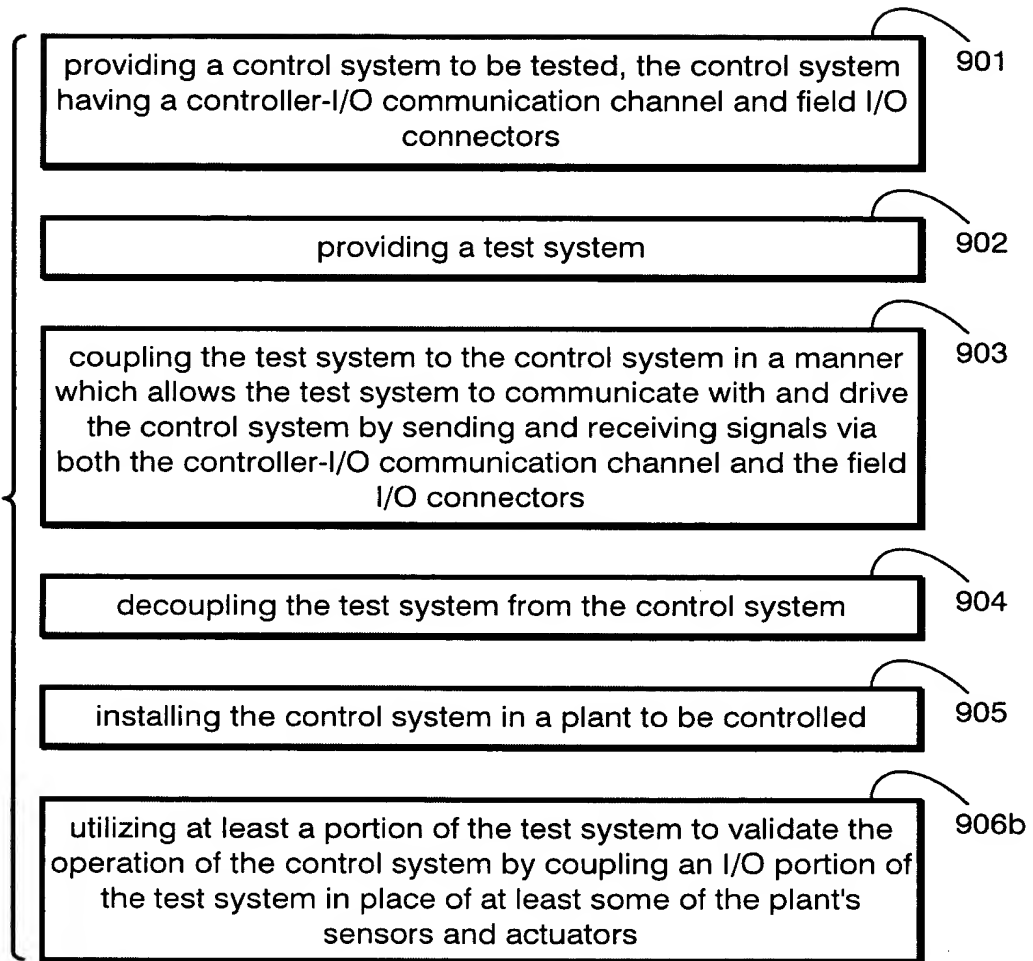
FIG. 16B

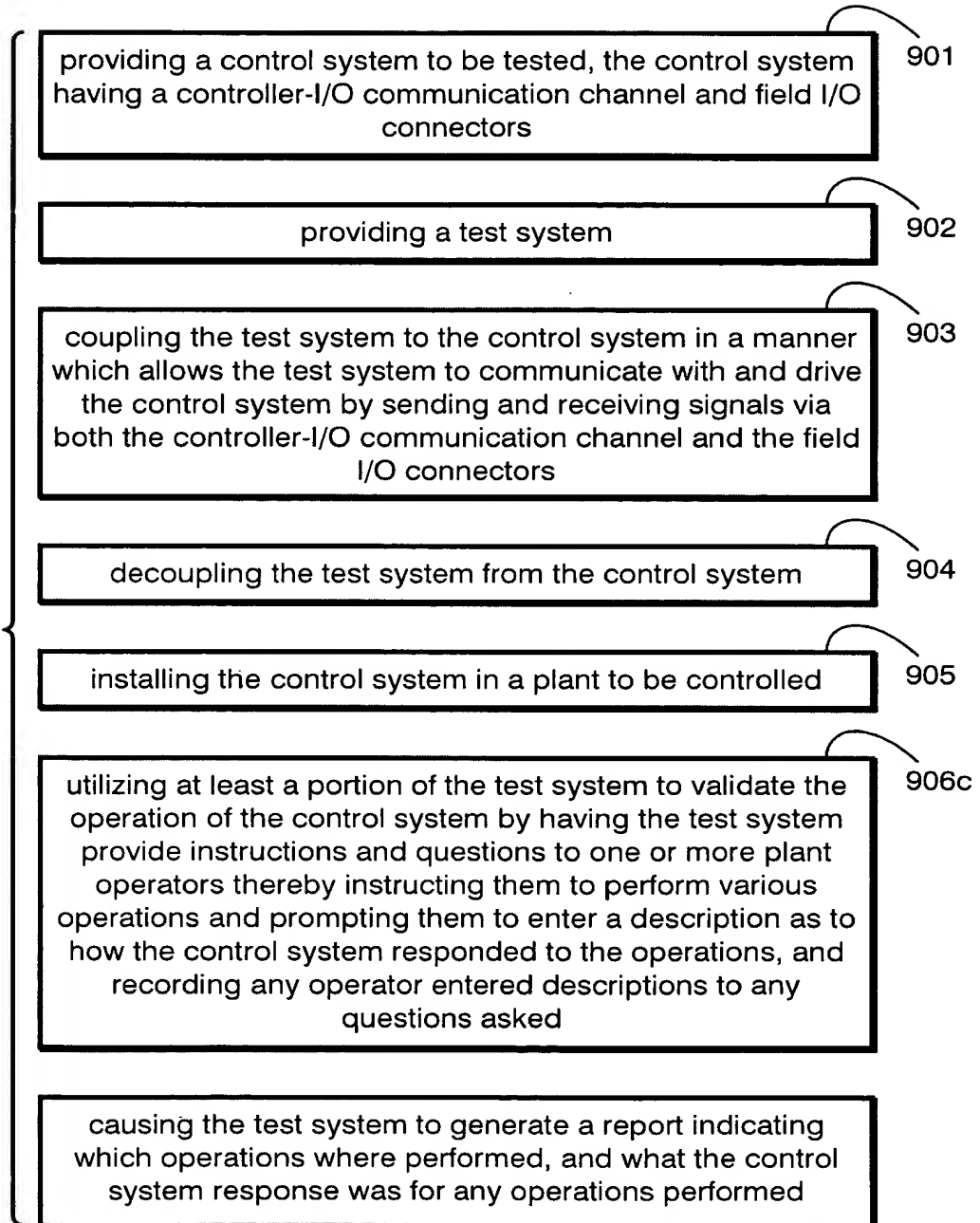
**FIG. 18**

ID	Section	Requirement	Question
	G.1	1	Security requirements related to hardware:
	G.1	2	Login requirements:
	G.1.2	1	Password protection required (Yes/No):
	G.1.2	2	Protection areas:
	G.1.2	3	Number of security levels:
	G.1.2	4	Security level names:
	G.1.2	5	Configurable levels (Yes/No):
	G.1.2	6	What can be configured?
	G.1.2	7	System restrictions:
	G.1.2	8	Other login requirements:
	G.2	1	PLC Specifications:
	G.2.1	1	Brand of PLC used:
	G.2.1	2	Type of PLC used:
	G.2.1	3	PLC quantity:
	G.2	2	Operating Conditions
	G.2.2	1	Ambient operating temperature range:
	G.2.2	2	Relative humidity range:
	G.2.2	3	RFI requirements:
	G.2.2	4	Other operating condition requirements:
	G.2	3	Hardware Requirements:
	G.2.3	1	Mounting requirements:
	G.2.3	2	Control network type:
	G.2.3	3	Access ports:
	G.2.3	4	I/O Network port required? (Yes/No)
	G.2.3	5	Other hardware requirements:
	G.2	4	PLC programming software:
	G.2	5	Electrical Specifications:
	G.2.5	1	Power supply:
	G.2.5	2	Electrical isolation requirements:
	G.2.5	3	Wiring requirements:
	G.2.5	4	Other electrical requirements:
	G.2	6	PLC Alarms:
	G.2.6	1	Hardware alarms:
	G.2.6	2	Software alarms:
	G.2.6	3	LED indications for diagnostic points required?
	G.2.6	4	Other PLC Alarms:
	G.2	7	Other PLC specific requirements:
	G.3	1	PC Specifications:
	G.3.1	1	Will a PC be used? (Yes/No)
	G.3.1	2	PC manufacturer preference:
	G.3.1	3	PC type (e.g., Tower, Desktop, etc.):
	G.3.1	4	PC processor type:
	G.3.1	5	RAM (MB) required:
	G.3.1	6	Number of PCs required:
	G.3	2	Laptop Specifications:
	G.3.2	1	Will a laptop be used? (Yes/No)



**FIG. 19****FIG. 20**

*FIG. 21*

*FIG. 22*

*FIG. 23*

providing a plant control system to be tested, the control system comprising a controller, an I/O interface, a sensor input port, an actuator output port, a series of communication segments communicatively coupling the sensor input port to the controller such that an input signal applied to the sensor input results in one or more signals traveling along each of the communication segments so as to notify the controller of the applied input signal, and a series of communication segments communicatively coupling the controller to the actuator output port such that a control signal generated by the controller results in an output signal being applied to the actuator output port

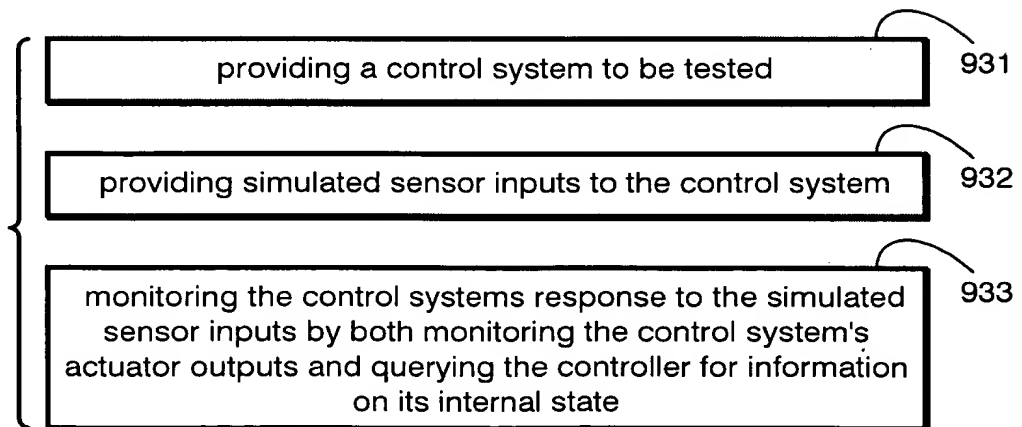
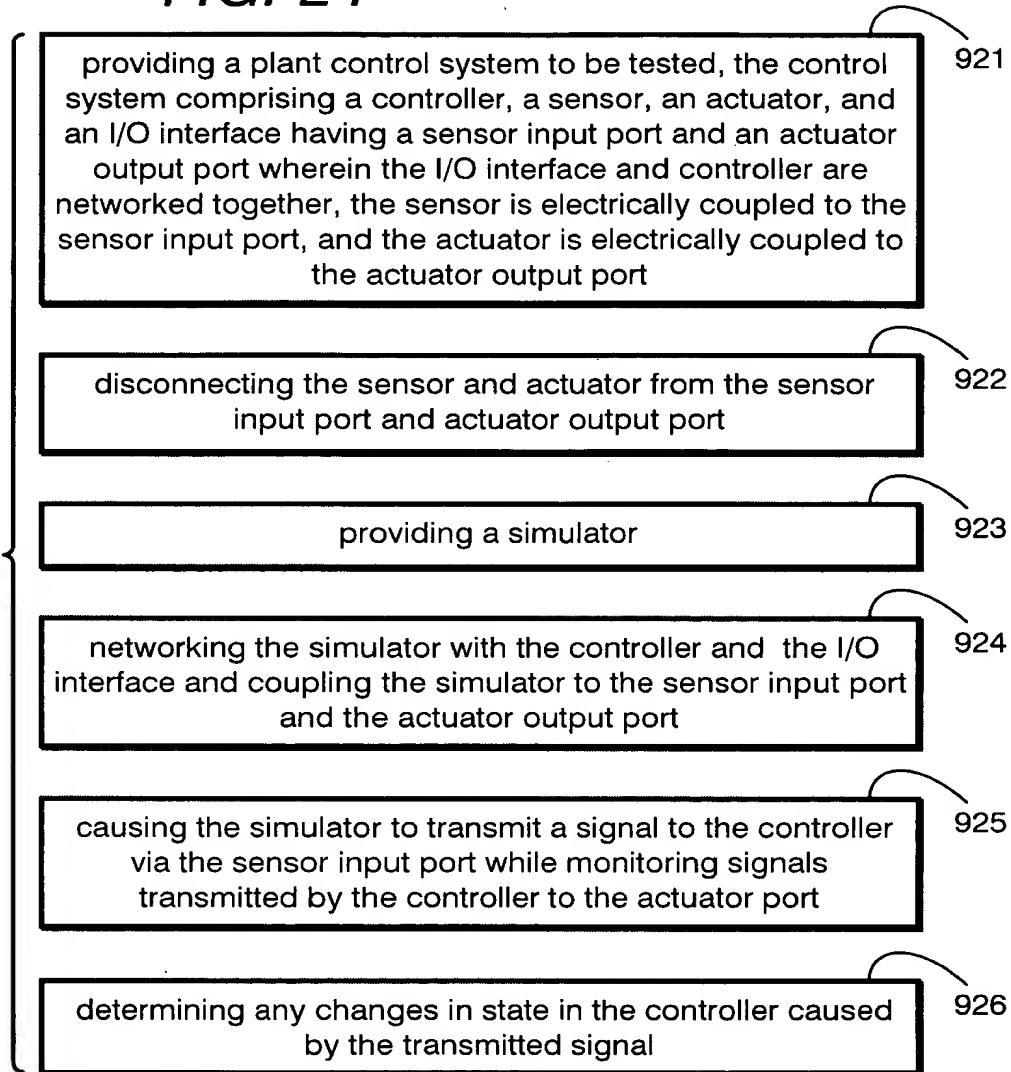
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providing a simulator, the simulator coupled to the control system at at least three points, wherein a first point is the sensor input port, a second point is a controller-I/O interface network access point from which data relating to the internal state of the controller can be obtained, and a third point is the actuator output port

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causing the simulator to apply a signal to the first point and to subsequently obtain data on the internal state of the controller and to monitor the actuator output port for any applied signals

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**FIG. 24****FIG. 25**

**FIG. 26**